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# RP in art and conceptual design

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## Abstract

This paper is a conclusion to one of the forum topics: "RP for Art and Conceptual Design" in the 2001 "Future of RP" Web conference. Art and conceptual design are often regarded as good places to apply concept-modelling technologies. However, the response from the forum and the author's observation reveal that the use of RP in art is limited to be used as "print-out". The use of RP in conceptual design is even more limited. A comparison between RP and conventional modelling techniques is made. The paper goes on to postulate that, the obstacle to adopting RP to art and conceptual design is rooted in common characters of commercial RP systems that are incompatible with the creative process.

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When we artists and industrial designers first saw the rapid prototyping (RP) machines, we were fascinated by how easy it would be to produce complicated 3D form from digital data. We embraced the "concept modeller" notion, and we started believing that RP could improve the creative process by providing effortless, immediate, and best of all, inexpensive 3D tactile feedback to the creator, and thus stimulated further innovation.

During the last two years, RP technology has progressed tremendously. We have the first commercial colour RP system; we have larger, faster, and more stable machines; and we have a new crop of software specialised in fiddling facets. The "Future of RP" forum is in the right time to review what we have achieved these last two years and what obstacles lay ahead.

## RP and the creative process

The forum topic "RP in art and conceptual design" looks weird at first sight for it attempts to link together art and conceptual design, two seemingly distinct fields. However, when we consider how the practitioners of the two fields work and put the two under the same camera this may reveal some very interesting findings. Most apparently, both fields are concerned with form and aesthetics, and both thrive on creativity and imagination. But a more profound similarity is that both art and conceptual design are recursive in nature. In the conception stage of these fields, a piece of work is usually a refinement of the previous one, and innovation is manifested in the act of creative recursion. The works, be it a sketch, a clay model, or a foam model, is not a presentation aid, but the direct result of object-creator interaction. Because of the undeterministic nature of creative process, these recursions are not always cleanly completed. During the process, the artists and designers evaluate the works at hand constantly, change the course spontaneously according to their inspiration, and abort abruptly unfruitful attempts (Kelly, 2001). Recursion in this sense is a vital part of innovation, and the effectiveness of the creative process depends on speedy and unhindered recursion.

While RP machines are generally regarded as highly automatic output technology, and rapid prototype parts as assessment aids for engineers and clients, in what way would RP

be a significant impact on the process of creation? To answer this question, we may draw our reference from some older “conceived to be” passive output technologies, such as printing, photography, and cinematography. During the course of their development, they were transformed by creative users from output technologies to an integral part of art and design creation.

In the position paper I have prepared for the forum, four topics are posted. They are devised to survey the extent to which RP technologies, especially concept modelling technologies are integrated into the creative process.

### Forum response and reflection

The most actively discussed topic is the creative use of RP for the evaluation of the conceptual design stage, and yet no response was received on RP for art. The indifferent response from the art circle may be attributed to the fact that the use of RP in art has already reached a plateau, that is, RP is accepted as “print-out” that enables the creation of sculptures that seem to have sprung directly from the artist’s mind (Rinder, 2001). Among all exhibits presented in the recent digital art exhibition[1], only three artists presented works that utilise RP facilities. The miniature chairs arrangement in *Poltergeist* by Paul Pfeiffer, the juxtaposition of organs in *Ajna Spine Series* by Michael Rees, and the distorted *skulls* by Robert Lazzarini are all based on deformation and re-composition of 3D scanned form. As compared to other digital artworks in the same exhibition, such as digital video installations, these RP sculptures are taking the role of “print-out” rather than meshing into the concept behind the work.

Determined by the current implementation of RP process, there are some characters common to all commercial RP systems that affect how RP integrate into the creative process. First of all, the sequence of RP part generation is unidirectional (usually from bottom to top). The whole form is ready for you to assess only after they are completed. Secondly the quality of data input to the RP system is stringently specified. You cannot input loosely defined data and expect the RP system to produce a loosely shaped object. Finally, The “black box” nature of most RP systems means that RP facilities expose

almost no inner circuitry for artists to explore and experiment. As a result it imposes a clear barrier, which separates digital manipulation activities from layering up of physical form. “From bits to atoms”, some of the RP advocates suggest it, is not the way to facilitate artistic exploration and recursion.

Among the forum responses, it is generally agreed that RP should not be restricted to simply the production of presentation models, for that will only limit our concern to the disadvantages of RP over traditional modelling techniques. Rather, RP should be applied to the conceptual design stage, which emphasises the form rather than finishing. I agree with the notion. But in practice, if the three common characters listed above remain, RP will not be able to cope with the “recursive” and “spontaneous” nature of conceptual design.

The majority of the forum response came from the design and architecture fields. Contributors argue that the potential of RP is not how realistic its output is, but the quickness of computer file to an accurate 3D. Some suggest massing as an example of this kind of conceptual design stage application. It is true that on some occasions RP can be used, but it is dubious to say it is a better tool. Acclaimed architect Frank Gehry uses CAD extensively for architectural design, but he limits the use of CAD to design development after a concept is selected. Traditional modelling materials such as wood blocks, tissues, transparent PVC sheets, etc. are used extensively for the study[2]. Confronted with the sheer quantity and size of conceptual design models built in each project and the evidence of vigorous re-composition involved in each of them, it is hard to imagine how CAD modelling can keep up with the flow of ideas, let alone producing models by RP.

The common characters listed above also restrict RP for product conceptual design, yet with some other subtle differences. Unlike art or architecture, the use of CAD in product design is already very popular. There are actually some product forms originated from CAD commands, which are almost not possible to define in the pre-CAD era. RP, being an exact replica of the virtual computer world should be readily adopted. However, it is not the case. In a recent trip to the Chicago region, I contacted four design consultancies of various sizes; none of them use concept modeller in their conceptual design stage.

Hand crafted or CNC machined foam modelling are still the favourite techniques for them. There are many reasons for this: size limitation, STL restriction, and above all, the problem related to the common characters.

Size is a serious limitation. Exact size is less critical to art and architecture because architectural conceptual models are scaled down anyway, and artwork is less concern with human factors. On the contrary, size is a crucial concern for product design. Currently there is no concept modelling class machine that can make parts larger than A4, that excludes the prototyping of Hi-Fi, many household appliances and furniture, etc. Conversely, in foam modelling, the designer can have the scale determined conveniently while they shape the foam.

Surface modelling is still the tool of choice for most product designers; the tight restriction of the STL format is therefore a headache. While in most circumstances only the “skin” of a product is drawn in the conceptual design stage, and for speedy modification the features are not booleaned but left to penetrate each other, all these practices are not tolerated by most of the RP systems.

The above two difficulties, no matter how serious, originate from RP system design. We can foresee that they can be solved by engineering means. However, difficulties caused by the common RP characters, which are rooted in the RP principle, are not as easy to solve.

Unlike RP conceptual modelling, in conventional foam modelling, designers can invest their time selectively to various portions of a product according to the level of importance of that portion to the overall design. If buttons are the focal point of a product, one can give more attention to them, leaving other parts loosely refined. Designers can also change their minds or stop at any stage before the whole foam model is completed if they conclude that they are not satisfied with the form. These practices are not possible with RP. Using RP, designers can

only evaluate their creation after the prototypes are completely built.

## Discussion

After all these years of promotion, rapid prototyping is not a nouveau technology any more, it is accepted as a convenient and automatic way to produce physical objects from a digital file. The next direction we should explore is how to merge RP into the creative process, so as to prepare our profession for the introduction of rapid manufacturing (RM).

RM is a revolution from “end to end”. The form of an RM product is liberated from constraints of the design tools and the production means. However, most of the studies done on design for RM are concentrated on the “process” rather than the “shape”. Besides the RP problem addressed previously, the other reason that we have not yet tapped into the full potential of RM is that, years of exposure to mass-produced products have shaped our taste quite a lot. A TV set that is shaped like Dan Collins may be more acceptable to the general public of the nineteenth century than that of our age. Until now, there is still no product produced solely by RM, so we will have to wait and see.

## Notes

- 1 BitStreams, Whitney Museum of American Art, 22 March–10 June, 2001.
- 2 Project for a New Guggenheim Museum in New York City. Solomon R. Guggenheim Museum, 19-25 April, 2001.

## Reference

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