Towards an empirical understanding of end users' application of 3D-printing

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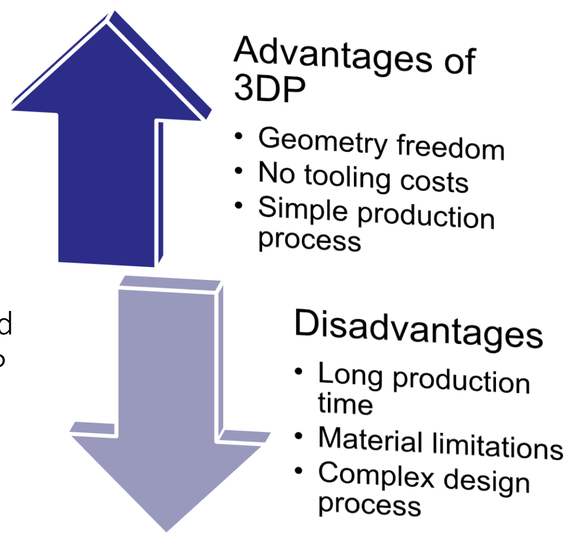
Abstract

3D printing (3DP) is an exciting technology offering a number of advantages over conventional manufacturing processes. While 3DP technology is already applied in production, 3DP device manufacturers and service providers are further trying to place products in the market aimed at the consumer. The assumption of a consumer embrace of 3DP also serves as basis for several research studies aiming to guide 3DP into the future, for example by developing new data formats or template editing paradigms. However, many of these efforts seem to be based on empirically unproven assumptions regarding future end-user adoption of 3DP. For example, it is widely implied that the primary attraction of 3DP to consumers is its ability to customise or individualise products.

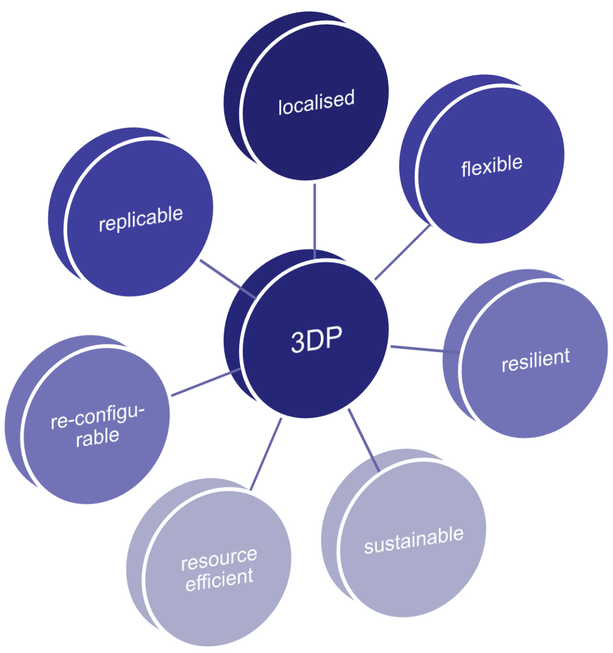
This research aims to establish a more empirically grounded expectation of what end users will see in 3DP technology and how they will use it. This poster will outline initial work on devising a research method to that end.

The Problem

3D printing (3DP), also referred to as additive manufacturing (AM), is a technology in which artefacts are produced by adding materials in layers until the product is complete. 3DP has a number of capabilities that confer certain advantages in manufacturing and production: Due to its additive (rather than subtracive) nature, it generally allows geometries that are otherwise difficult to obtain. Further, it can sequentially produce different types of artefacts without need for re-tooling. Materials that can be 3D printed include polymers and plastics, but also wood, glass, ceramics, resin, metals, etc. 3DP is already used as a manufacturing method and has been referred to as an opportunity to re-imagine both the manufacturing of goods and the way they are consumed.



However, the same attributes that make up the advantages of 3DP, e.g., the elimination of product-specific tooling and assembly lines, also contribute to its disadvantages: 3DP is a relatively slow process, and it may easily take several hours to produce relatively small artefacts. Further, while polymer 3D printers are relatively cheap and easy to use, printers for more sturdy materials such as metal are relatively expensive.



It has been suggested that 3DP as a technology has a direct application to the end user, who may use this technology to have products customised, individualised, modified or manufactured to the end user's specification. Indeed, there is an active community of 3DP enthusiasts, i.e., the so-called maker movement. Further, some business ventures have managed to successfully market 3DP in one form or another to end users (while others have admittedly failed).

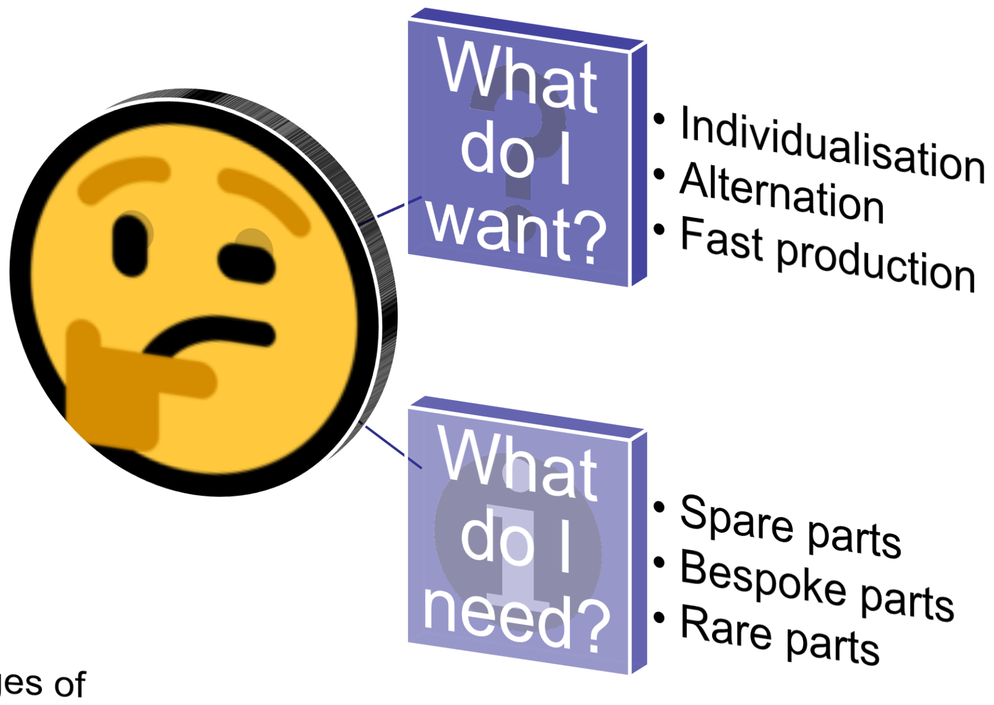
Further, a number of ongoing research and business development initiatives around 3D printing continue to rely on the concept of 3DP in the end user mass market. However, a review of the literature suggests that proposed effects, uses, products, technologies or services base the expected application or consumption of 3DP by the end user on assumptions, sometimes explicit, but more often implicit.

Example

Existing research often implied that 3DP manufacturing will be more sustainable and resource efficient due to an a priori *change in consumption patters: End-users would be less inclined to dispose of individualised everyday products. However, this assumption is naive: Simplified individualisation of everyday products might just as well lead to increased production of fashionable or "fad of the day" items, and thus wastage.*

Aims and Objectives

This research is motivated by the view that it is necessary to understand first how end users are likely to apply 3DP technology, and what 3D printed artefacts end users would want to create or consume.



With such an understanding, potential products, service and technologies may base their development on an empirical basis rather than unsupported assumptions. To that end, it is proposed to explore how 3DP is understood by laypersons and how they would try to apply this technology in the future, provided they had access to it.

This research aims to gain an understanding what needs consumers have that are not fulfilled at scale by the current combination of manufacturing processes, distribution methods, and business structures. Based on this understanding, potential needs of consumers will be identified that 3DP might be able to plug.

Methodology

A fundamental issue in data collection for this research is that today's consumption, consumer behaviour, and expectations, are in many ways likely to have been influenced by predominant manufacturing and consumption paradigms. It cannot be assumed that participants in data collection have a realistic (i.e., opportunity- and limitation-aware) view of 3DP. Hence, data collection should focus on their unfulfilled needs and wants. At the moment, this research focuses on the following data collection methods:

•Workshops training potential participants about 3DP and the use of CAD software, following which they are cued via interviews or questionnaires about possible applications of the technology for their personal use.

•From such workshops or other venues, participants might be recruited for keeping diaries (potentially as an app) in which participants note down when they are in need of an artefact that they can't buy, but could have 3D printed.

The issue becomes noteworthy when considering, e.g., the use of 3DP to create spare parts. 3DP as a production method is close to ideal for this end since it is not dependent on mass production, but merely on the availability of the necessary digital information. However, it needs to be asked if consumers have not only the awareness for the possibilities of 3DP, but also the desire to have items repaired (as opposed to, let's say, experiencing the purchase of a newer, more fashionable replacement). Hence, in the course of this research, participants could for example not be primed to think of spare part production by specifically asking for the use of 3DP in repairing items.

Conclusions

One of the desired outcomes of this study is to obtain a perspective into whether consumers are more interested in further aesthetic individualisation of products, or rather functional customisation. Further, we expect an indication whether there is an actual need to actually have items printed quasi-immediately, rather than having them shipped.