Hospital of Objects. Recycling plastic from the small electronic devices to redesign old objects by the 3d printers

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Abstract: "Hospital of Objects" is a service that provides for the recovery of forgotten, obsolete and accidentally broken objects, it fall within typical chain of personal manufacturing. Through the design input of the designer / maker, the obsolete object reacquires an aesthetic and functional dignity, according to the contemporary hybrid design and hacking design logic. The aim is to give new life to small everyday objects, recomposing, aggregating or replacing some parts with new parts 3d printed, using filament obtained from the recycling plastic of WEEE waste. The service through the exchange of expertise (including Laboratory for the recycling of WEEE and Rapid Manufacturing Laboratory), cooperation (between user and designer / maker), attention to environmental impact, leading to the creation of a particular product: hybrid of languages and technologies, that allows experiments in the field of recycling, technology and creativity, exploiting the 3D Printing aimed at small-scale production or unique pieces.

Keywords: 3D printing, WEEE, Plastics, Recycle, Recovery

1. Introduction

1.1 Planned obsolescence and Perceived Obsolescence

The current production process for each type of manufactured article is a linear system defined "from cradle to grave" and what today designers and advertisers define "life cycle of the product" is actually nothing more than obsolescence. considered a precise production strategy. Compared to the past, now manufacturers generate, constantly, new product categories to persuade the owners to replace the old with the new, according to the logic of "designing for the dump" employing real tricks thought to make obsolete and unfit needs products ahead of time. In this behavior, defined as "planned obsolescence", joins the "perceived obsolescence", the behavior of those consumers who need to stay ahead with fashion and its constant changes: they
both contribute to the same logic and the exponential increase of quantities of waste, especially plastic.

1.2 The issue of waste
Despite the increasing presence of waste collection services and the growing awareness raising of this issue, we continue to live in a world in which 90% of waste which pollute our seas and about 12% of the total municipal solid waste materials plastics principally derived from consumer products. The problems related to consumption are the result of the speed with which exhausts the usefulness of the resources that we exploit. By a linear process, the ideal would be a change of direction that leads to a circular system "from cradle to gate."
In our linear economic system, when goods is no longer needed is thrown into dump or incinerated. At best is recycled, that is recombined into shapes necessarily any less pure than the original ones considered of a lesser value. The reason for this devaluation depends on whether the materials that comprise the goods are not pure, but hybrid, composed of different substances, which once blended together become difficult to separate.

1.3 Conscious Designing
In order to succeed to move from a linear system to a cyclic system should eliminate the concept of waste and starting from the design, studying the "nutrient flow," and separating the flows of biological nutrients (anything that can be put back into the cycle life of the earth without danger) and technical nutrients (all that remains of a good and that can be "upcycled", ie used again increasing in value). Consumer products are the ones that you consume, as the word itself suggests, should be designed so that their release in the land and in the atmosphere, is not dangerous. A basic condition to get the expected results is a deep transformation of the market, which provides a real change of the entire economic and trim paradigm of traditional industrial production. The important thing would be transition from an economy of brute force in an economy of intellectual power, where technological expertise, knowledge and sharing are the central resource for new economic activities (Blue Economy). In fact we should get used to to buy services rather than products, and to perceive, understand and be able to exploit the potential that wastes have. This is the goal of Systemic Design.

1.4 The role of Systemic Design
Systemic design is the discipline that allows you to define and plan the flow (throughput) of materials that flows from one system to another in a continuous metabolization which reduces the carbon footprint and generates a significant economic flow, especially at local level. The project organizes and optimizes all actors and parties within the field, so that they can develop evolving, coherently with each other. The singol parts of the system interface in order to form a virtuous net (autopoietic) of relations between the flows of material, energy and information flows. The goal is the local social well-being entire system, not one-way.
2.1 Human being and Object
Our homes are filled with objects that possess varying degrees of usefulness and indispensability. Objects are unquestionable facts of everyday life and, today more than ever, our possessions have never been bigger as a result of what is called product maturity that "obliges" to continually replace old products with new ones.
Today, the passion towards the possessed object is consumed almost in the same moment in which we acquire, destroying completely, the value and identity; this conception, it was once totally inverted, so that the inherited objects had much more value than new ones, because designed and manufactured to be durable and accompanying people all throughout their lives.
In contrast, the life cycle of a product that was once estimated in decades, now is measured in a few months and the product is soon considered of little use, a waste.

2.2 The refuse concept
The refuse is linked to the concept of worthlessness, the word itself, inevitably, leads to its opposite: the utility that is defined in terms of the functionality exercised, in view of certain purposes.
The refuse is the useless, that is, the unusable, or what is, by its own nature or by reason of some accidental event, excluding any possibility of use.
Despite all that, paradoxically, the consumer still persists a tendency to preserve old objects no longer used, or even not working.
If you analyze our possessions, from a semiotic point of view, they can be considered an integral part of an individual's life both psychically and emotionally, in fact, contribute to building the personality, participate in the formation of character guaranteeing continuity of his being in time. Unacceptable to consider them a waste. Many objects, now, entering the waste circuit when still possess infinite possibilities of use. The object considered obsolete and useless may, from another point of view, be seen as something good for a productive transformation process and/or converted into new product.

3. 3D printing

3.1 Third Industrial Revolution

The phenomenon, that is developing like wildfire, is the basis of a true democratic revolution in industrial production: with the reduction of the cost of the machines, the production is moving towards a decentralized form, on-site and on-demand, of the consumer products and not, thus laying the foundations of the Third Industrial Revolution.

The 3D printing is part of the "Additive Manufacturing" cycle, different from the "Subtractive Manufacturing" typical of the traditional production processes and better consolidated.

The market opportunities are significant in the hobbies and crafts field, particularly for Makers, new digital artisans (modeling, toys, accessories, jewelry, footwear, fashion, ceramics, sculpture, restoration parts, pastries), to create objects unique or personalized, direct production in the FabLab or through service centers.

In the industrial field, the most promising markets in addition to the rapid prototyping, are: the automotive and aerospace industries, precision engineering, implants and other medical devices which require a high level of customization and complexity. Although the continued spread of additive manufacturing and the benefits that derive from it compared to the subtractive manufacturing, such as the significant reduction of material waste, the 3D printers have been consolidated, only, in specific areas such as rapid prototyping (important for the improvement of the life cycle of a product) and tend to a personal production (personal manufacturing) and small-scale, thanks to the spread of FDM technology, anticipating a return to dislocated production.

Figure 2. The diagram shows which are currently the main fields of application of three-dimensional printing.
3.2 3D printing and environmental impact

According to a recent study by Michigan Technological University, the production through 3D printers implies lower energy expenditure by 47% compared to the traditional manufacturing. But consider the 3D printing as the one and only solution to ecological production management, is risky. A negative note on the environmental impact caused by the three-dimensional printers, however, it emerges from another research conducted by M. Kurman and H. Lipson, co-authors of the book Fabricated, which underline especially two negative factors:

- the energy consumption, significantly higher than of the classical industrial machines;
- the high dependency on plastic materials (in particular the FDM technologies that work by extrusion of thermoplastic polymers).

Given that for additive manufacturing the most developed fields fall into the rapid prototyping of test specimens destined to the testing phase or formal check, while for the personal manufacturing concerns the production of gadgets and "no deposit" supports, it is clear that the environmental impact, due unconscious use of plastic materials, is a decisive element for the effective and sustainable development of these technologies.

How 3D printing can reduce the environmental impact due to the use not very consciously of plastic? We live in a situation in which we are, unfortunately, submerged by tons of wastes, toxic and nontoxic, caused, for the most part, by industrial production without criteria; find a balance between production, consumption (economy) and the environment could be the key to success.

4. The service: The Hospital of Objects

Imagining a typical chain of personal manufacturing which provides an active role of the final consumer, the involvement of the production places such as Fab-Labs or otherwise, of laboratories that offer 3D Print services and working according to the logic of the Do-It-Yourself in addition to the planning and managerial contribution of generation of designers defined precisely Makers, was born the project "Hospital of Objects", developed by Sapienza Design Factory Laboratory in collaboration with the Laboratory R4R of ENEA Casaccia research center. The perspective is in parallel with the recovery and recycling where systemic design plays a key role. The user’s role is active, ie to create a its output an input that can move the complete system using new technologies, the logic of the DIY, the world of the Fab Labs, the makers, professionals, designers.
Figure 3. The diagram shows how, also in this case, in the context of an autopoietic system, the uselessness of waste could reconfigure itself from another point of view as something useful for a process of transformation production and/or having in view its own transformation into a new product.

The input consists of obsolete objects, disused, to which the user is attached and WEEE category R4, the present case, old devices: smartphones, tablets, old keyboards and mouses, clock radios, consoles.

Exchange, the cooperation, the meeting of needs and different skills, leading to the creation of a final product, one of a kind, a hybrid of languages and technologies, that allows experiments in the field of recycling, technology and creativity, embracing also the logical 3d printing technology oriented to the production of small-scale or unique pieces.

"The hospital of objects" is a multi-professional laboratory where the forgotten objects, obsolete or accidentally broken objects, are reconditioned, restored, made hybrids, hacked, or just plain restored, according to customer needs, with technology three-dimensional printing, and all the techniques and methodologies typical of the Time Compression Technology.

The service includes the choice by the user of two types of recovery of objects:

- the first based on the restoration and then functional restoration of ceramic objects that recalls to the concept of traditional restoration (which aims to just plain life extension of the manufactured with the help of the new 3D printing technologies);
- the second, called "RAEESugi" (which is linked to the ancient art of kintsugi, the Japanese technique to repair broken ceramic objects with gold or silver cast, giving back the object a large semantic value).
It provides a first step where to recycle the old WEEE category R4, to give life to the filament for the next 3d printing, and a step of free design based about hybrid and hacking logic.

The aim is to give new life to small everyday objects (with a strong semantic value) recomposing, aggregating or substituting part of them with new parts made through the FDM 3D printing filament obtained from the recycling of old WEEE category R4.

The added value of the service choice "RAEESugi" consists in having made an "ecological" choice giving rise to a authentic, technological, unique and functional object.
Figure 5. Small broken ceramic vase restored and rendered usable again by adding a new shell printed in FDM with polymers derived from waste WEEE.

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