Fab Labs. New hubs for socialization and innovation

Annalisa Di Roma*, Vincenzo Minenna**, Alessandra Scarcelli***

*Polytechnic of Bari
**Corresponding author email: annalisa.diroma@poliba.it,
***Corresponding author email: vincenzo.minenna@poliba.it

Abstract: The present paper focuses on the cultural value of making, identifying the methods for sharing the knowledge and the technical skills, particularly, in the context of digital design and fabrication. Starting from the renewed interest in manufacturing processes directly linked to creativity, sustainability, mass customization, practical innovation and experimentation, enhanced by the so called makers’ revolution and by the new arts and crafts movements, the paper explores the ongoing transformations in the manufacturing places focusing on the Fab Lab sites as new hubs for sharing knowledge and skills.

The dissertation is supported by a practical experimentation, carried out by the authors, based on a co-design workshop and a proactive interdisciplinary activity addressed to identify the processes of social innovation involving both expert and not expert designers in the context of digital design and fabrication processes.

As a result Bright Light, a small lamp, has been produced in order to finalize the co-design processes with a smart artefact.

Keywords: Social design and Innovation, Digital design and fabrication, Makers movements, Arts and Crafts movements

1. Introduction

The present paper aims at to define a methodological approach to the theme of the social innovation based on practical experimentation made in the context of the digital design and fabrication.

The first part of the paper will be addressed to define the framework of the social innovation in the context of the creativity, starting with the definition of the scenario of the digital revolution results in

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1 The text has been written by the authors sharing the methodological approach, the references, and the conclusion. The articulation of the text in paragraphs has been developed as follow: 2.1 Annalisa Di Roma, 2.2 Alessandra Scarcelli, 3.1 Vincenzo Minenna.

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the context of a new making philosophy (paragraph 2.1) and focusing on the role of the fab lab as physic spaces for a new connection between makers (paragraph 2.2).

The second part of the paper will provide the description of a study case carried out by the authors, based on a proactive activity addressed to 1) building up a fab lab; 2) involving a group of not expert designers together with an interdisciplinary expert’s group of tutors in a workshop based on a co-design approaches, for the introduction to the digital design and fabrication and to the smart technology.

2. Digital fabrication and social innovation

2.1 Making: the role of the material culture in the post-digital era

The digital revolution in its first expression has had an immediate effect on the distancing between the designer and the material objects. As a consequence it has produced a new dimension for the user experience (from the virtual prototyping to the photorealistic representation, from the virtual movies to the augmented reality) and new forms of social communities remotely organized (on line and off line) and focused on common interests, on the open design processes, on the sharing of the results. This process has been characterized by the open sources philosophy (Boldrini, Levine, 2012, pp. 22-24) that has opened to new form of social cooperation in the design processes. The fourth industrial revolution has been in effect, properly, when productive system has started to be connected with the design processes with a new possibility for designer, expert or not, and user, expert or not, to interact; as a result nowadays a new era of the material culture defines a role for the expert designer as a "mediator between technological demands and social and cultural issues (Manzini, 2015, p. 49), giving rise to a new era of creativity (2.0) that has a new form of gratification in making for itself and for the others (Gauntlett, 2013, p. 19). In this light a new page of the material culture, that contains the history of techniques, materials and making processes (De Fusco, 2012, p. 42) could be written. In fact, as Hauser intends, “the history of the Art could be defined as the continuous renew, enlarging and improvement of the tool for its expression, [...] as a harmonious equilibrium between the power an will, between the instruments and the artistic intension” (Hauser, 1956, p.114). This equilibrium between technical and intellectual evolution could be upset by the social organization of the work and not just from the equipment in itself. The material and technical aspects of the creative processes, in fact, could feed creativity and could weave a dense network of connections with the physic environment, intended as the productive places, placed in the context of the cities, re-establishing new connection between social life and work places. Making implies connection, with materials, other people and the world (Gauntlett, 2013, p. 56). Nowadays, beside the “virtual plaza”, the digital fabrication places (Fab Labs) are playing a new role in connecting people and in giving a new expression of the joy of labour, where the value of making is in the creative process and a new democracy could take place. At this connection Branzi says:

“New robotic technologies has reduced the distance between consumer and producer and allow to produce customized small series of craft objects, but also arms - such as drones - genetic engineering, nano - technologies, robotic organisms; post Fordist factory seems to entrust to new technologies and new materials, the role of opening new dimensions to democracy “. (Branzi, 2015, pp. 14-15)

In fact, as traditional manufacturing district (crafts districts, pottery districts, textile districts, etc.) where placed in the centre of the ancient city, where cultural and leisure activity also took places, the new fab lab are today organized, from the smaller one to the bigger one, in the context of the city.
The industrial revolution, since its beginning, defines an ideological and physical separation and specialization of the city areas: manufacturing areas, civics areas, cultural area, etc.

The fab labs are now a day playing a new role as “workshops” places in which creativity and manufacturing are re-connected as new spaces for socialization and share culture.

Now a day, when everyone design, and everyone makes, new intersection between creativity and production allowed new models to be explored by design disciplines, not just from the skills and tools point of view, but also form the social dynamic point of view, also based on co-design processes.

As Ezio Manzini intends:

“Obviously, the notion of co-design intended here is not standard one found in formalized processes where a team of stakeholders discusses round a table, trying to create a common language and share visions and strategies. What I mean by co-design, is more like a vast, multifaceted conversation among individuals and groups who set design initiatives rolling at the nodes of the networks they are part of: social conversation in which different actors interact in different ways (from collaborating to conflicting) and at a different time (in real time or off-line) (Manzini, 2015, pp. 48-49).”

![Figure 1. Participants and tutor of the workshop Ma.Te.Ri.A at co-working.](image)

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2 In this connection Manzini also says:

“[...] we can say that these co-design processes are characterized as follow:

- Highly dynamic processes: these include linear co-design processes and consensus-building methodologies (i.e., the most traditional view on participatory design and co-design processes). [...]"

- Creative and proactive activities, where the design experts’ role is one of mediator (between different interest) and facilitator (of other participants’ ideas and initiatives), but also includes the design experts’ creativity and culture (i.e., their ability to conceive large scenarios and/or original design proposal) and the possibility of using them to trigger the social conversation and to feed it with new ideas.

- Complex design activities that call for specific tool (to visualize ideas and make them tangible through different kinds of prototypes): a set of dedicated and designed artefacts that i the design experts’ responsibility to conceive and create.”

(Manzini, 2015, pp. 48-49)
2.2 Making: the social role of the laboratory

The Fab Labs present themselves as organized physical places equipped with specific machinery. The Fab Labs are open and accessible to anyone who wants to share with other makers, the experience of experimental research in the Digital Fabrication field, in a supportive and collaborative environment. The Fab Foundation of MIT’s Center for Bits and Atoms (CBA), place in which the phenomenon of Fab Lab was born and spread, defines it as:

“a technical prototyping platform for innovation and invention, providing stimulus for local entrepreneurship. A Fab Lab is also a platform for learning and innovation: a place to play, to create, to learn, to mentor, to invent. To be a Fab Lab means connecting to a global community of learners, educators, technologists, researchers, makers and innovators - a knowledge sharing network that spans 30 countries and 24 time zones. Because all Fab Labs share common tools and processes, the program is building a global network, a distributed laboratory for research and invention.” (http://www.fabfoundation.org/index.php/what-is-a-fab-lab/index.html)

Obviously, in addition to specific technical and instrumental aspects belonging to the digital field, the essential qualities that characterize each Fab Lab are accessibility, social inclusion, a sense of widespread community and collaboration.

"Collaboration can be defined, roughly, as an exchange in which participants benefit from being together. It’s a behavior [...] immediately recognizable, because reciprocal aid is innate in the genes of all social animals: work together to achieve what would be impossible to achieve alone.” (Sennett, 2012, p. 15)

Specifically, Sennett defines collaboration existing in the Fab Lab as "difficult and challenging", including persons who may have nothing in common, but instead distant competences and interests. A collaboration that requires dialogic arts, namely social and technical skills, as the philosophical Aristotle’s meaning, the ability to perform with competence a practice task.

In a complex society, like the ours is became, there is a trend to disqualify the person in respect to this type of collaboration, spreading on the other hand the fear and mistrust of other people and promoting cultural homologation processes.

However, the crisis of political and economic systems is really the main causes of the spread of opposing processes for the education of social groups. The difficulty pushes man to help each other, and to activate its technical skills to face practical and tangible situations, rather than ethical skill.

Every period of transition, marked by changes and innovations in technology and production fields, inevitably implicates repercussions on sociability level\(^3\). The experimental sphere always requires configuration of new forms of collaboration.

If, in the industrial era, the closest reference to the Fab Lab and Makers could be found in the Arts & Crafts movement, the social issue linked to the collective production environments is much older, dates back to the establishment of the workshops of the ancient world, from carpenters to potters, from goldsmiths to weavers.

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\(^3\) Sociability: The ability to live in society, and the complex of elements and groups in a given society and their relationships. This term describes also the concrete forms in which this attitude manifests itself (group, community, mass etc.), guided by different types of need and interest. This term is preferred to sociality as this last is less evaluative, and preferred to association as this includes both the relations of rapprochement between different social groups (defined as associations) as well as the relationship like war, conflicts etc., involving distance or hostility. (Online Treccani)
The structure of the laboratory evolves over the time, adjusting the instrumental and technical apparatus, but keeps unchanged some principles of social order: the laboratory set up itself as a community, with relationship and solidarity forms expressed through codes and rituals.

The British movement of the Arts & Crafts began as critical reflection about the themes of social instability connected to the second Industrial Revolution. William Morris, that was the heir of the theories on the Gothic Revival of Pugin and Ruskin and was also permeated by the Fourier’s communist ideal, dedicate all its activities to fight the spread of the new industrial and capitalist system, that in his opinion, was the main cause of the aesthetic and cultural impoverishment of nineteenth civil society.

The ugliness of industrial products derived not only from inadequate development policies for the entrepreneurs of that age, but above all from having separate, in the production phase, the author from his artefact. The Arts & Craft had tried to find a solution to the sense of alienation felt by the workers, proposing happy social models, which recalled the Renaissance workshops: in these laboratories artists and craftsmen collaborated in the manufacturing, the ideal material took shape through manual processes, physical process, which returned to the individual the joy in labour that was lost.

Although anachronistic and utopian, the proposal of Morris identified those social problems that inevitably every revolution brings with it.

The new industrial production model imposed the specialization of the tasks, within the assembly line, and the isolation of each individual in its mechanical and repetitive competence. Such specialization has effectively disqualified the individual in the social sphere (Sennett, 2012, p.19)

The alternative model, the craft workshop instead configured itself as a corporation, consisting in a multiplicity of skills, arts and crafts, that cooperated, following ethical principles, to achieve a common objective.

3. Study case

3.1 Bright light: co-design, creative and proactive workshop

Bright Light is the experimentation of smart manufacturing carried out by the authors into the framework of Ma.Te.Ri.A, a social participatory project. This project has been launched to promote the “Rigenera” urban workshop of Palo del Colle and has been set inside the project “Mettici Le Mani” of “Bollenti Spiriti”, which, since 2010 coordinates some activities aimed to support the creation and the recovery of the social and territorial disadvantages by the means of support activities and capacity building.

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4 News from Nowhere, published in 1891, fully describes the conflict between Morris and industrial society. The novel retraced his socialist ideals, in a utopian community vision without divisions into social classes, consists of freely associated families, which collaborate with each other for the common good, where the absence of money and of property concept eliminates hierarchies power.

5 The project Ma.Te.Ri.A. has been carried out for six weeks. Scientific committee: Andrea Mangiatordi and Vincenzo Minenna, co-working area; Vincenzo Minenna, modeling and design area; Pietro Boccadoro, electronic area. Staff: Graziana Tagarelli, Antimo Farina, Mariachiara Chiarulli, Aurelio Carella.
This experimentation is the result of a creative and proactive workshop that has been conceived starting from the analysis of the current training courses about the themes of innovation\(^6\) and the digital manufacture, provided in the regional territory. As a result of this analysis phase the exclusive presence of training courses held by private educational body (as digital consulting or distribution software companies) must been underlined and therefore the total lack of local divulging centers, as for example the Fab Lab\(^7\). Another aspect pointed out by this analysis is about the covered topics that mainly concerned with the use of professional software (about building and production) and they are addressed especially to consumers having a high formation closed to making and hacking themes.

An other critical result emerged from the first analysis phase is the lack of updating of formative and design methods. The main problems found are: the total absence of participative and laboratory characteristic, since the consumer doesn't have any interaction with the process of analysis, choice and design; the limited access to the course, since the participant has to provide personal techniques and technologies competences as a basis condition to enter.

\(^6\) The analysis phase has concerned with the scouting of the current teaching course addressed to the digital innovation and to the smart manufacturing in the context of the Apulia Regional Territory.

\(^7\) Fab Foundation: The four qualities and requirements listed below are essential for the building up of a Fab Lab.

First and foremost, public access to the Fab Lab is essential. Fab Labs support and subscribe to the Fab Lab charter: http://fab.cba.mit.edu/about/charter/

The Fab Labs have to share a common set of tools and processes. The idea is that all the labs can share knowledge, designs, and collaborate across international borders. If I can make something here in Boston and send you the files and documentation, you should be able to reproduce it there, easily. The Fab Labs must participate in the larger, global Fab Lab network. This is about being part of a global, knowledge-sharing community.

(http://www.fabfoundation.org/index.php/what-qualifies-as-a-fab-lab/index.html)
Based on these considerations, the workshop has been structured including innovation\textsuperscript{8} themes and the design methods that has been improved implementing a holistic approach.

This second phase is realized through the identification of macro objectives and of related development criteria, as:

- To identify methods concerning the social inclusion through the participatory project planning practice, specifically the co-design.
- To approach the digital manufacture through the divulging of the production methods developing inside the Fab Lab;
- To promote the concepts of the open source and open hardware through the matching of different knowledge;
- To apply home-made and small scale production methods.

\textbf{Figure 3. Workshop Ma.Te.Ri.A: specific tools and machinery in the laboratory.}

The choice of these objectives and methods is necessary to conjugate in a unique project the phases of knowledge, share and realization intended as an inseparable triad to be realized by step and test.

The following stage, preparatory to the realization of the workshop, concerns the organization of a promoting event of the workshop on the digital manufacture, through a seminar illustrating the subjects and the potentialities of the course. In the event, a focus group has described and verified the activities (modules and laboratories), the times and the expected results, underlining the aspects of inclusiveness and of co-design belonging to all the actors in the different choice and development phases.

\textsuperscript{8} The individualization of the themes springs from some studies effected in the web in which the offer of the workshops is analyzed on it climbs global individualizing in this last those that had the best answers in terms participating.
After this event, the data obtained by the focus group has been subsequently analyzed, and has allowed optimize the plan and the definitions of the modules according to the needs and to the participant’s profile with the related experiences and knowledge of the covered themes.

The knowledge of these data has allowed focusing on several formative (languages, technical and design competences) and organizational aspects of the workshop. The interventions have been optimized and further, different modules of close examination and experimentation have been added to the achievement of intermediary objectives.

In the last phase of the experimentation, the workshop has been subdivided in four modules. This division even if has been imposed by practical aspects, as space and time management, however each module is not independent, but participates with the others to the definition of the project and to the continuous and transversal depth examination of the specific themes.

The modules were divided in smart manufacturing, design and three-dimensional modeling, three-dimensional print and automation of the prototype, following by tutor expert on each the disciplines.

The first form concerned the smart manufacturing and the user experience through the use of the USD (User center design system. A preliminary briefing evaluated the knowledge of the participants and subsequently the tutors of the different modules reported on the principal methods, on the possible interaction between modules and on the possibility to use the making and hacking technique, driving force to combine seemingly different operations.

Further issues in this module were the open source and the open hardware, which have been described through the explanation of the potentialities of the main parametric-generative software of modeling, the three-dimensional prototyping and the low-cost programmable hardware platforms.

The remainders three modules had practical character and different aims: the first objective was to unify knowledge on the three-dimensional modeling related to additive 3D printing techniques; the second objective was to introduce to the generative and parametric design through the use of the software Rhinoceros, specifically the plug-in Grasshopper; the last objective was to explain the product automation, emphasizing the potential of open source and open hardware systems, and in particular on the use of the Arduino.

The assessment was carried out during the course of the module through a series of exercises and tests.

The result of the workshop has led to the creation of a smart manufacturing product: a table lamp able to detecting human presence, and then to change the position of some components, the color and light intensity.

The choice of this product has resulted in the activities carried out by the participants. In fact, the lamp is designed in relation to the automation components (Arduino, sensors, motor, switches, power supply and lighting) in grasshopper (parameterization process of the body pattern) and then optimized for 3D printing Gcode with a PLA filament.

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9 The choice of the geometry has been explained during the final presentation at the end of the workshop, in fact the participants to the workshop has opened a debate regarding the theme of the geometry and its aesthetic value.

10 The participant to the workshop were 32, between 16 and the 48 years old, much more male, with different educational level.

11 The User Centered Design (UCD) has been defined and described by different authors and even from some norms ISO as the ISO 13407, Human-centered design process, the ISO 9241-110 Dialogue Principles (mod. 2006). ISO 9241-210 https://www.iso.org/obp/ui/#iso:std:52075:en

12 Grasshopper is a graphic editor of algorithms integrated with the tools of modeling 3D of Rhino.
4. Conclusions

The design philosophy at the time *when everyone design and makes*, connected in a networked, shifts the focus of the interest of the project research towards the development of those tools aimed at enhancing the co-design experience. A new focus is the development of "open" projects, to be intended open to the multiples possibility to be designed and realized by a community of people, with the main interest in making and in sharing culture and know how. The digital revolution, in fact, has impacted both design and production processes, giving a new meaning to the serial production towards the mass customization. The 2.0 craft re-connects the tradition of material culture, that stratifies the technical knowledge related with materiality and materials, techniques and technologies, artefacts and works of art, and contribute to strengthen the relationship between productive places and socialization. In fact, craft and design are based on the close connection that creativity is able to establish with the production places, with its political and social context. Focusing on the cultural value of creative processes a new form of social innovation could be enhanced.

These aspects are integrated into an innovation process that regards on the one hand technology and production systems, and on the other with the sense of the artefacts, responsive to social needs more than to market needs.
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About the Authors:

**Annalisa Di Roma** PhD Associate Professor in Industrial Design at the Polytechnic of Bari. Actively involved in the Apulian Regional industrial and creative districts, member of the “Design in Puglia” Regional Commission. Research interest are focused on the integration between the digital design and manufacture with the traditional Material Culture.

**Vincenzo Minenna** Degree in architecture, PhD researcher and adjunct professor in Industrial Design at the Polytechnic of Bari; specializes on parametric design and author of several scientific essays about the subject Lithic Design and Parametric Design.

**Alessandra Scarcelli** Degree in architecture, PhD researcher and adjunct professor in Industrial Design at the Polytechnic of Bari; specializes in Lighting Design. His current research deals with cross-cutting areas of product design, visual communication and social design.