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and change

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# **Pervasive, disruptive, seductive, enabling: Designing technologies for learning and social innovation**

*Patrizia Marti\**

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## **Abstract**

“There are no technological revolutions without cultural transformations.” This is a quote from the book “The Internet Galaxy: Reflections on the Internet, Business, and Society” by Manuel Castells (2003), in which the author explores the complexity of the social problems generated by the spread of the Internet.

Nowadays the Internet is no longer simply a means for connecting people through computers. The digital components of the network have materialized in things. Information has ceased to travel exclusively on the computer screen and moved onto physical objects, now able to talk to each other and with the environment.

The challenge is that this technological innovation will become a social innovation, and that individuals, society, institutions and companies will appropriate it, modifying it, transforming it, and experimenting with it.

This paper is a reflection on the role of technology in supporting social innovation. We will approach this topic from the perspective of interaction design, a discipline that studies social practices connected with use of

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technologies, and imagines new possibilities as well as new activities enabled by them.

The reflection will develop by presenting the outcomes of Light through Culture, an international educational project that aims to create a meaningful context for learning in which students reflect on socio-cultural issues together by building interactive installations.

**Keywords:** co-learning, learning by building, reflective practice, social innovation, craftsmanship, design

## Introduction

For years, scientists and developers of technologies have pursued the dream of creating imposing technological infrastructures with the promise that they would solve the big problems we face today, particularly those that may be summed up under the triad of environmental, social and economic sustainability.

Their ambition has however come up against a series of hurdles due to the cost and complexity of constructing imposing, diffuse technological infrastructures, while the model of technological diffusion from above has not turned out to be successful.

However, we are now seeing a series of pervasive, spontaneous phenomena emerging in connection with the use of technologies, which permit an entirely different vision of society, leading to development of alternative solutions and approaches.

In 2014, there were more subscribers to mobile telephone services than people in the world (source: ITU World Telecommunication / ICT Indicators database). Smartphones are equipped with a great variety of sensors and devices: cameras, video cameras, microphones, GPS systems and accelerometers, to mention only a few.

The mobile telephone makes ordinary citizens into potential data gatherers, people who can use an item they utilize every day to collect a whole series of data, all over the world, at a very low cost.

The idea of getting citizens involved in the monitoring and control of the environment they live in, in the broadest sense of the term, meaning both territory and socio-cultural space, is known under the name *Participatory Sensing*: a movement that observes and collects

masses of highly detailed information that can then be used to improve quality of life in a great variety of different sectors, from environment to health and culture (Goldman *et al.*, 2009).

Illustrious examples of Participatory Sensing include those developed by the University of California, Los Angeles, where students were involved in projects ranging from improvement of transportation to recycling, water monitoring, safety and health (<http://www.mobilizingcs.org/about/participatory-sensing>)

The participatory approach to identification of technological solutions for social innovation also has another important form, incarnated in the Makers and Digital Fabrication philosophy. While Participatory Sensing sees citizens primarily as potential “data gatherers”, the Makers movement is based on a culture of innovative construction.

Makers are inventors, people who enjoy making things by hand, applying their own creativity, technique and skill. The concept is one of “digital craftsmanship”, in which the craftsman uses new tools and technologies that have become accessible to all to reinvent a disappearing profession.

The maker is inspired by the philosophy of making things for the pleasure of doing it, sharing with others and learning from others.

The movement has spread all over the world. The Maker Faire, a key annual event for the community, had about 100,000 participants at its most recent edition, in Rome. The fair has been held every year since 2006, all over the world. In 2005, O'Reilly launched Make, a quarterly magazine for the Maker community.

Production of goods and services has always been the prerogative of the big corporations, which offered their customers little possibility for customizing and modifying their products; it is now possible to shift the production process toward the single individual, who invents, builds and distributes products and information, offering his or her counterparts the greatest variability and transformability of the product of his or her work.

Technologies which are now easily accessible, versatile and economical, such as the Arduino platform (a little open source microprocessor which costs only a few dozen euros, for prototyping with electronics), 3D printers (which, for the cost of a conventional

laser printer, can produce objects out of a variety of materials), and even simple mobile phones, anyone can potentially create, build, customize or modify objects and collect a significant amount of data.

This opens up a new way of thinking about technologies, and new roles for the people who use them: from the citizen who collects and distributes data to the digital craftsperson and the inventor. All these roles share the same philosophy of building, knowing and sharing with the goal of promoting innovation in a participatory society.

The design discipline can contribute to this goal most directly and immediately by putting its assets of creative thought and skilled craftsmanship materializing and experimenting with ideas and solutions at the service of change.

The design of products, services and technological systems is in fact inextricably and inevitably linked with society, and has very profound social consequences. The questions the designer must answer are very complex, do not have a single solution, and are enriched and changed with time, making the designer's task very difficult. Designing innovation for societal growth means, for instance, bridging the generation gap and the cultural gap dug by technologies, finding solutions for sustainable consumption, reducing inequalities and enabling mechanisms of shared, common reflection and growth.

There is no single response to questions of this type, but as educators, we can definitely make a contribution to the process of social innovation by educating a new generation of designers who are capable of addressing these issues, working across the disciplines of engineering, design, the arts and the social sciences. The challenge is to educate designers capable of establishing a vision of the society of the future, which innovates not only in technology, but also by generating socio-cultural innovation through use of technologies permitting people to transform and improve their existence.

In this paper I present "Light through Culture", a project which began in 2011 and is still underway with the aim of educating young designers in the development of innovative solutions for facing the major social challenges of life today.

The project is based on the concept of "Making" and making together, and on acquisition of a cultural sensitivity that brings designers closer to people and their hopes and desires.



It is promoted in a partnership by the University of Siena, Eindhoven University of Technology and Interactive Institute Swedish ICT, and the past four editions have seen the involvement of bachelor's, master's and PhD students.

## **Crafts and bodily engagement**

Light through Culture proposes a learning activity that holds “Making” in its core. Students are encouraged, through cycles of reflection-on-action (Schön, 1983), to develop their personal understanding of the problem at hand, to prototype ideas, and to present the final designed artefacts in public exhibitions, inviting people to bodily engagement and reflection.

The vision of this learning activity is closely connected with reflective practice and craftsmanship, where knowledge is acquired through the exercise of craft-inspired learning practices throughout design and fabrication processes (Sennett, 2008).

The objective of the project has two main pivots: (1) to encourage the application of a design and learning process centred on skills and crafts, and (2) to provide an assignment that aims to elicit bodily engagement of people who can directly experience the design outcome.

In order to promote a new craftsmanship (the first pivot), students have to acquire a material consciousness, to use Sennett's words (2008): new materials must be combined with traditional materials, and they must deal with digital technology as a material. Physical computing technologies such as those mentioned above make this possible. Light through Culture promotes learning through the combination of digital and traditional crafts.

The second pivot of the project leverages on the concept of embodiment (Dourish, 2001). The assignment given to students is to build an exhibition, that is, to create ways of experiencing an issue in society and the related values so as to stimulate reflection through taking an active stance on that issue. This requirement of experience ability aims to go beyond more traditional ways of learning in which “information” is provided to a mostly passive learner. In this project, the students have to design embodied experiences in which cognitive

skills are triggered in addition to social, emotional and perceptual skills. The aim is to design exhibitions that require people to engage in meaningful dialogue created through interactive possibilities, and to take a responsible stance on the issues raised.

## **Light through Culture**

As we have seen, Light through Culture is a project that explores socio-cultural themes through innovative technologies. Four editions of the project have taken place so far, each ending with an interactive exhibition in a museum or historic building in Siena, Italy.

The reason for this choice of setting for the exhibitions is that design of interactive installations is a highly iterative process, entailing repetitive transition from the conceptual to the physical realm and back again, thus enabling a gradual synthesis and understanding of limitations and potentials, and of the complex relationship between the design act, the contents, and the fabrication approaches to be achieved. Continued reflection on contents and the learning itself is critical to the knowledge gained during each phase of the design and fabrication process. The students learn by actively constructing meaning in a socio-cultural environment (constructivism) (Birenbaum, 2003), they learn through doing and reflect on their actions (reflective practice) (Pollard, 2005), and they have a desire to do good work for its own sake, like all craftsmen.

The first edition of the project was hosted at the Museum Santa Maria della Scala in Siena. A team of twelve MA students designed an experiential path along the ancient pilgrimage route passing through the Santa Maria della Scala, that was a hospital at that time where the pilgrims could be given shelter and care on their way. Five interactive installations developing along a path in the Museum underground, invited the contemporary visitors as new pilgrims metaphorically travelling toward the enlightenment, the hope, the alleviation (Marti & Overbeeke, 2011). A video of the exhibition is available at <https://vimeo.com/23830663>.

The second edition of the Light through Culture proposed a reflection on the individual vs. social perception of human rights. Details of this edition are provided below.

The third edition aimed to stimulate awareness of women's rights. The project faced the themes of violence, self-determination and emancipation. The installation merged embodied and situated perspectives of visitors (offline) with virtual (online) perspectives expressed by people active on social media (Marti *et al.*, 2015). A video of the exhibition is available at <https://vimeo.com/83584195>.

The fourth edition of the project proposed three designs to enable deliberative processes to engage citizens as active participants to the political life of their city. The solutions are described below.

In the following, we focus on the second and fourth edition of Light through Culture. Both projects help to illustrate how design can stimulate reflection on societal issues and promote a common and shared awareness.

## **Experiencing human rights**

Experiencing Human Rights is the title of the second edition of Light through Culture, which proposed reflection on individual vs. social perception of human rights (Marti *et al.*, 2013). Students from the University of Siena (Communication Science Department and the International Master on Human Rights and Genocide Studies) and Eindhoven University of Technology (Department of Industrial Design) explored two articles of the Universal Declaration of Human Rights, concerning freedom of movement (article 13) and freedom of expression (article 19).

Through intense design investigation, students worked on the Universal Declaration of Human Rights and collected stories of violations. This material was then transformed into an exhibition that provided a continuous experience for visitors.

The video of the exhibition is available at <https://vimeo.com/50476772>.

The showcase created awareness of specific topics and demonstrated, through bodily engagement, how controversial taking a position on such topics can be. Visitors walked around in a space conceived as an interactive path containing different installations, where they experienced the application or negation of human rights.

The experience concurred in stimulating and reinforcing reflection on the relevance, complexity and universality of these rights.

The exhibition was hosted in the Museum of Santa Maria della Scala in Siena. A number of the installations contained in the space are described below.

### *The Introduction Space*

A life-sized video projection of a woman sitting on a chair and reading was projected at the entrance to the space (Figure 1). The video was sensitive to the presence of people facing it: as visitors approached the projection, the woman glanced up for a few seconds and then continued reading. When visitors moved closer, the character stopped reading and started to tell her story concerning her personal experience of violation of rights. During the tale, the woman quoted the articles of the Universal Declaration of the Human Rights concerning freedom of movement and freedom of expression. As soon as she mentioned them, the text of the articles appeared on the opposite wall so that visitors could read them. After a while, the woman invited the visitors to move on to the next room and went back to reading her book.

**Figure 1.** Introduction Space



### *The conflict space: Roma and local people*

The next room contained an interactive installation on the confrontation between Roma and local people. The space consisted of two panels facing each other and displaying the opposing opinion of Roma and local people on the right to obtain public housing from the municipality (Figure 2).

When no one was present in the space, a dynamic lighting pattern moved in between the two perspectives, sometimes lingering on one or the other, or in between. When a visitor entered the space, he could control the light that illuminated one or the other of the panels by stepping onto an interactive footboard. The visitor could decide to highlight one of the two points of view or to let the judgment remain suspended by letting the lighting continue to dwell and move in between the two perspectives. It was a tough confrontation, requiring visitors to engage bodily in order to express their point of view, taking an active stance on the issue.

**Figure 2.** The Conflict space



### *Expression space: voices from China*

This installation consisted of a set of speakers hanging from the ceiling at different heights (Figure 3, left). As visitors approached the installation, the voice of the Chinese authoritarian regime seemed to dominate the scene, sounding loudly throughout the space from a large red speaker playing a recording of a speech by Mao Zedung. The visitor could reduce its dominance by lifting one of the small black speakers hanging in the space and listening to the recorded voice of

Chinese dissident artist Ai Weiwei. The visitor gives the dissident a voice that could not be heard otherwise. Lifting one of the small speakers drew the attention of the large speaker, which moved closer, attempting to interfere so as to remain dominant.

**Figure 3.** Expression Space: Voices of China



Visitors could engage with the installation bodily by lifting the small speakers, shifting the balance of power (Figure 3, right).

### *Censorship space*

This installation changed the visitor from a passive observer into a role of involvement. On one side, visitors saw a poster of a group of protestors marching in a demonstration. As they turned away from this scene and toward a screen, they suddenly found themselves among the protestors, being symbolically silenced by an unknown power. Visitors experienced the effect of censorship on their own bodies (Figure 4).

### *Tahrir Square space*

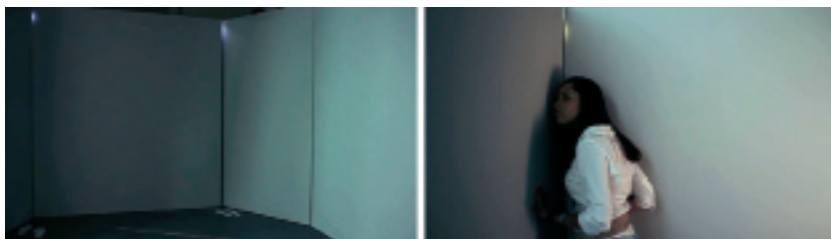
The last installation was an empty space representing a conceptualized memory of Tahrir square (Figure 5). Real voices of people peacefully demonstrating to defend their rights during the Arab Spring were broadcast in the space in the form of whispers coming from the walls. Dynamic flickering lights pulsing from inside gaps in the walls of the square attracted the attention of visitors, who could listen to the demonstrators' voices by putting an ear on the spot indicated by

the light. Visitors heard a short recording testifying to the personal experiences of demonstrators in the square.

**Figure 4.** Censorship space



**Figure 5.** The Square of the Arab Spring



## Design for Politics

The fourth edition of the project, titled Design for Politics, took place in 2014. This edition's theme was inspired by the political, economic and value-related crisis that is now affecting all of Europe. The project

aimed to explore how citizens can cope with the crisis and be engaged in envisioning the future of their cities.

The project was developed in Siena, a city that has historically been accustomed to attributing to local communities (e.g. *contradas*, public associations) the role of promoting initiatives for safeguarding the organization and the cultural and economical development of the territory. Unfortunately, the most important institutions in the city, which have historically supported the local community, are now experiencing a fundamental crisis that directly affects the forms of institutional arrangements, both public and private.

This situation requires constant dialogue with citizens and a return to the participatory approach that characterized the life of the city in the past. It is fundamental to listen to the city, to learn from past examples of good government that historically characterized the city (e.g. *Costituto*, the ancient constitution of Siena published in 1309), and to involve citizens in envisioning the future of the city, proposing a way to move forward.

But how can citizens be actively involved in these new forms of dialogue? How is it possible to generate the right motivation, convincing citizens of the need for and importance of their participation in society?

How can young people be encouraged to take part in politics, a world they now consider and perceive as some sort of parallel universe, far removed from the problems of everyday life?

These are the questions the three teams of students of various disciplines (communication, design, engineering, political science) and different cultural backgrounds (Sweden, The Netherlands, Italy, Brazil, India) attempted to answer.

During analysis of the project, the students investigated the approaches and methods of participatory democracy, with experts' assistance.

Bobbio (2004) identifies three levels of participation in democratic life. In the first level, participants merely listen to the technicians and administrators with the aim of formulating and assessing their contributions. With this approach, the administrators have the decision-making power in their hands.



In the second level of participation, citizens become directly involved in the choice of plans, and are asked to debate a topic, contributing their own vision and offering the technicians an opportunity to work with the observations they have thus collected. In this case, “the recipients’ influence depends on the facilitator’s ability to bring out the participants’ demands and the ability to listen of the technicians and those promoting the process.” At this level of interaction, it is still the technicians who hold the power to make decisions, and to decide whether to apply the participants’ suggestions.

The third level is made up of citizens who play an active role in the process, working actively with the administration, possibly with the assistance of an external facilitator, to seek a solution to a problem considered to be everyone’s problem. In this case, the community plays an important and influential role, and is considered the key player in social change.

The third level includes decision-making, precisely because of the consideration and value placed on citizens’ proposals and active participation. In this model, citizens become involved right away, from the earliest phases of formation of a shared political conscience, including searching for and identifying the subsequent phases of reflection on the themes of the debate. This model, therefore, has the potential to offer a way of encouraging citizens to cooperate in the search for solutions to social and political dilemmas, adding active involvement which does not stop with the choice of people to represent them in political elections.

On the basis of this type of analysis, of interviews conducted with citizens on issues of common interest, and of the study of examples of good government taken from the history of the city of Siena, students came up with three projects supporting processes of deliberative democracy. Videos of the installations are available at <https://vimeo.com/98062969>.

### *(Y)our Perspectives*

It is an app allowing citizens and administrators to launch consultations regarding issues of public interest via smartphone (Figure 6).

Polls are spatialized, that is, made accessible in the parts of the city involved in the study. For example, citizens who pass by the area where the stadium will be built may launch a survey of people's opinions on the advisability of building a stadium in the city. When a person walks by the area where the stadium is to be built, the app sends her the poll, in push mode. The person receiving the notification may respond to the question posed while on the site, viewing the context. Responses will be available to the community, and participants will be able to state the reasons for their decisions.

**Figure 6.** (Y)our perspective: the app



### *“Paint It!”*

It is an interactive installation allowing institutions to give citizens a voice and discuss values, problems and possible solutions with them (Figure 7). The system consists of a device that looks and works like a crossbow, located in Piazza del Campo, the main square in the city of Siena, across from the front of the town hall. The facade of this building is used as a palette onto which opinions and values related to it are projected. Citizens are asked to express an opinion by writing a brief message using the screen integrated in the crossbow. Once they have put together their message, they can choose which part of the building's facade to project it on, and then shoot their “arrow”, which is in actually a projection of the message onto the façade of the city hall. The public display of opinions on a specific issue encourages discussion and debate among citizens, offering them a direct channel for communicating with the city authorities.

**Figure 7.** Paint It!

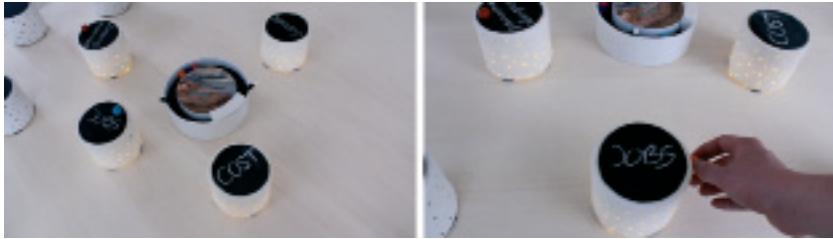


### *The Aesthetics of Politics*

This is a modular interactive system that encourages discussion and helps people acquire different points of view and how they relate to one another (Figure 8). The system consists of a table and a series of interactive cylinders on which each of the participants to the discussion may write their opinion. Each cylinder may be shifted to represent how close or how far away it is in relation to a given position. Brief excerpts of conversation may be recorded and listened to at a later time by attaching or removing little tokens on the sides of the cylinders. The closer the cylinders come to the main topic of the discussion, the brighter they are lit. The cylinders' movements are automatically saved to permit later reconstruction of key points in the discussion.

In this edition of *Light through Culture*, the projects were once again exhibited to citizens in Siena and Eindhoven. On both occasions, ordinary citizens and administrators asked to use the tools to concretely experiment with decision-making processes. They all acknowledged the highly innovative nature of the initiative and its potential to bring about cultural change in participation and decision-making.

**Figure 8.** The Aesthetics of Politics



## Concluding comments

In this article, we have addressed the issue of social change and presented the experience of Light through Culture. Through this experience, we wished to demonstrate how certain processes of social innovation can be enabled by technologies, and how it is possible to educate young designers to acquire an awareness of social issues by offering them the conceptual tools and skills they need to address.

The universities involved in Light through Culture held courses and educational projects aimed at encouraging students of different disciplines to work together, materializing ideas and building systems that permit direct experience of social issues.

During the project, students experimented with the potential of design to catalyse a cultural shift concerning social awareness. The assignment had an explicit socio-cultural focus that encouraged reflection on societal issues by eliciting direct bodily engagement of people.

There are two levels of reflections that arise from such an experience. One concerns the learning experience of students participating in Light through Culture, and the second refers to how people received the final design outcome.

The act of learning by building, experiencing and reflecting upon the products created enables students to learn through direct bodily engagement and mature a personal viewpoint that prepares them to be able to take a stance and confront others' viewpoints in a respectful way. Having to deal with extremely complex themes, such

as human rights and deliberative democracy, and having to bring these abstract themes into the sensory realm of experienceability, trains them in cycles of iteration, going from the abstract to the concrete, and therefore developing design expertise. The university students acquired design, technical, organisational and management skills. They gained research methodologies for producing contents, while in parallel developing strong skills in forming (design) languages to convey their deep understanding of these contents.

Regarding people's reception of the project outcomes, we can state that the overall judgment was positive. Their impressions were recorded in different ways: in visitor books, on social media, through informal interviews conducted during the exhibitions. The evaluation continued after some time, to assess if and how the first impressions consolidated into more articulated reflections. The data indicated that people matured strong impressions from the exhibitions; some of them experienced difficulties and cultivated doubts, especially due to the unusual interactive format of the exhibitions. Most of them appreciated the effectiveness of the interactive experience in provoking reflection and raising doubts.

Overall, Light through Culture is an educational activity that confronts all the complexity of a real environment: the results are physical, virtual and mixed, new realities consisting of new ways of presenting and adding new dimensions to the existing world.

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