

## **The integration of open source design and fablab [practices] into Interaction Design Education**

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### **Abstract**

Practices related to open source hardware and software, open design, and digital fabrication are increasingly affecting the way things are designed and produced. These issues are having an impact on the way technology-driven innovation is generated, and in particular on the process of designing innovative products and services, which designers and prospective designers are not completely aware of. Within this process, community-driven platforms and spaces dedicated to electronic prototyping and digital fabrication have a main role: they offer the information and tools for implementing physical and interactive objects and they become the new libraries for making. In the context of interaction design education the combination of these libraries play a pivotal role in the teaching and learning process. Students access open source tools and knowledge while using digital fabrication machine to develop the design of the artifacts.

In our experience as interaction designers and educators in the field of interaction design, one of the main sources of efficiency in education was the integration of a fablab into the infrastructures of our Master of Advanced Studies. Furthermore, the urge for physical prototyping, based on the use of open source hardware and software platforms, brings our students in contact with the issues connected with intellectual property (IP). Even though Swiss jurisdiction on IP allows for reproductions and copies within the educational environment without copyright infringement, we envision a system in which students and teachers focus on the use of Creative Commons licenses and make the results of their interaction design activity available in the same way they can profit of the open knowledge approach of the open source communities, namely those connected with design and technology. The goal is to experiment the implementation of the open source approach and the fablab format into a European academic curriculum.

The aim of our paper is to present the integration of these elements in the design process from a methodological viewpoint, focusing also on by-products such as how to return the knowledge produced in design schools to the open knowledge and open source community. The paper addresses several and more general challenges such as: the use of Creative Commons license within universities, the requirements for an expanded documentation of interactive prototypes (text, code, licenses, images, video, audio, sketches), open interfaces and tools for accessing these resources.

### **Interaction design and the craft of technology**

The work of interaction design practitioners concerns the definition of the quality of the experience between users and technological devices [1], and in order to do so they adopt methods and techniques such as sketching, paper prototyping, development of computer

programs and hardware that embody digital and physical artefacts' behaviour in working prototypes [2].

Interaction designers are also professionals who are trained for working in multidisciplinary teams for the development of technological products by bringing their knowledge in design thinking, literacy, awareness and practice in projects depending on hardware and software implementation [3]. While the matter of interaction design consists in intangible materials (communication, modalities, feedbacks, behaviours etc.), the practice of designing is strongly related to the ability of crafting interactive experiences that is requiring nowadays a stronger knowledge in prototyping web languages and hardware and software platforms. The work of interaction designers is increasingly based on the reflective practice as well as on craft [4, 5].

This shift is generated by several factors:

- the technological development in itself asks designers to have a wider and deeper understanding of current methods, languages and platforms addressed to the hardware and software implementation;
- the availability of easy to use prototyping platforms and tools, such as Arduino, Processing, etc.;
- the accessibility to on-line shared information about those platforms and tools [6, 7] and, in general, about technologies available on the market [8];
- within the interaction design research, the re-examination of computation in more material terms [9] brought to emphasize fields such as physical computing.

We assume that some of the above mentioned disruptive factors are also enabled by the practices and values developed within the open source and fablab communities rather than only within the web 2.0 culture. Those practices and values envision and promote alternative ways of creating physical goods and innovation systems, therefore must be taken into account when reflecting on the role of interaction design and, consequently, on the future system of interaction design education.

In an educational context where the approach is based on learning-by-doing, peer to peer design, social product development, interaction designers may be asked to play a two-faced role by providing an expertise for the development of the open source and fablab ecosystem and at the same time by taking advantage from it by practicing novel approaches and methods generated within that context.

Therefore which kind of education for the interaction designers operating in the open source and fablab ecosystem shall we envision?

### **1. Interaction design education: learning by doing and peer learning**

Maind - Master of Advanced Studies in Interaction Design SUPSI is a one year postgraduate program organized by the University of Applied Sciences and Arts of Southern Switzerland. The program focuses on teaching the fundamental knowledge and skills of the interaction design discipline and it has been conceived according to the idea that interaction design practice is strongly intertwined with the ability of crafting interactive systems through the application of methods and techniques of the design culture (awareness, thinking, literacy). The program

schedules a series of workshops whose aim is to level the design skills and technical knowledge of the participants who have different backgrounds, from design to engineering, up to humanities. The main design courses are also practice-based and require the realization of functioning prototypes as a final assignment.

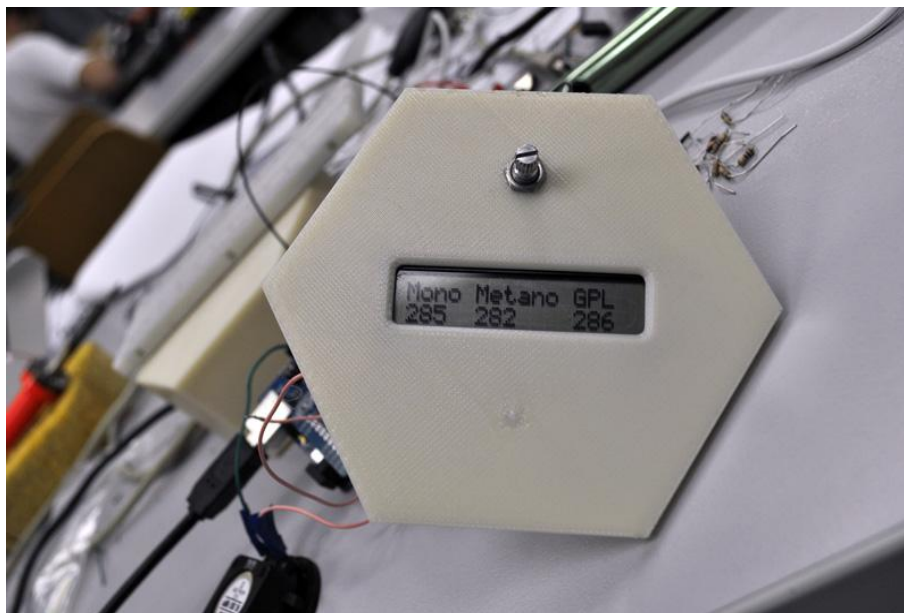
By following and refining a common approach in interaction design education [10], Maind proposes two main educational approaches:

- learning by doing activities. All training is based on hands-on activities and design workshop held by interaction design practitioners;
- peer learning. Students with different backgrounds are admitted to the program with the purpose of enabling multidisciplinary collaborations in projects development, as well as peer learning.

In order to support the above mentioned approach, the Fablab at SUPSI in Lugano has been set up in February 2012. The main goal was to provide students of Maind program with digital fabrication tools for the development of the master projects prototypes. Students access the Fablab and are allowed to directly interact with the machines after a training on the safety procedures and on the techniques of 3D modeling and digital fabrication.

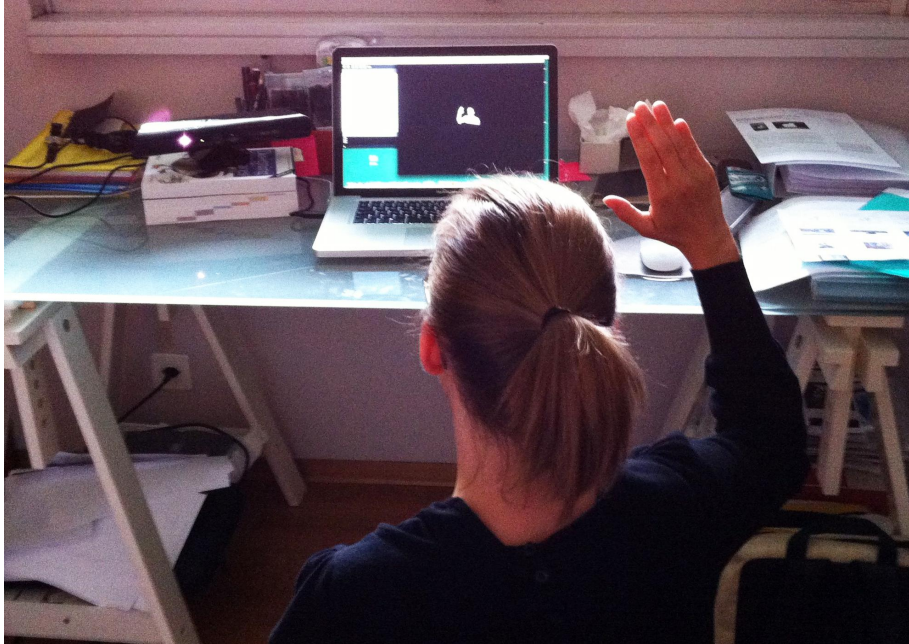
The integration of the Fablab in master program facilities opened up the following unpredictable educational opportunities and results:

1. integration of digital fabrication and open design in the briefs of the main design courses;
2. development of master thesis on topics related to digital fabrication and fablabs;
3. organization of experimental workshops that integrate open hardware and design [11].



**Fig. 1. Beehive - Modular Safety System, 2012.**

Project by Alberto Tacconi, issued from the course Designing Advanced Artifacts held by Massimo Banzi, Innocenzo Rifino and Diego Rossi. Goal of the course was to design and implement interactive objects that are open and connected, whose design and behaviour can be customised by end users.



**Fig 2. Consuelo Keller project, 2012.**

Master thesis project by Consuelo Keller, supervised by Fred Voorhorst. The final work of a Mainz student was devoted to the elaboration of a holistic service including 3D scanning and 3D printing of food (such as chocolate, biscuits etc.).



**Fig 3. Summer school “Designing for the Third Industrial Revolution”, 2012.**

The summer workshops series addressed the realization of interactive projects through digital fabrication, open source platforms and open design wearable collections (in the picture: Balance Belt by Thomas Amberg). (in the picture: Balance Belt by Thomas Amberg)

## 2. Crafting the integration of fablab and open source culture in the curriculum

Assessing the preliminary impact of the integration of the fablab environment together with open source principles in the interaction design education at our program, the need to craft a future of educational system emerged:

- What kind of knowledge and skills must be transferred to interaction design students in a context where the interaction design practice is combined with a training on digital fabrication as developed within fablab culture and in the perspective of open source?
- How education programs in interaction design at universities can benefit from peer learning and peer to peer design and innovation? And how the communities of fablabs and open source can receive a contribution from educational programs in interaction design?
- How is it possible to integrate educational programs in the fablab and open source ecosystem?

In order to facilitate this integration, we started to design an educational model based on the following key elements:

- **Integration through theory and methods.** Integration can be enabled by conveying key elements of the open hardware, design and fablab values. For this reason, the program includes new typologies of courses that aim to provide students with the systematic knowledge about open source in the field of technology and design and specific lectures covering the state of the art of digital fabrication as well as techniques and technologies typical of a fablab. Courses cover the basics for developing open design processes and projects, as well as the issues regarding the protection and the sharing of intellectual property in the design discipline.
- **Integration through practice:** integration can be also reached by supporting the creation of new values in the interaction design practice similarly to those in the field of software development (i.e. collaboration versus customer consultancy) [12]. Students are trained on a specific method for the development of projects which includes the production of an expanded documentation, whereas “expanded documentation” means the release of the technical specifications of the project assignments in a way that other people can reuse, modify and build upon them in accordance with the current definitions of open source software, hardware and design and available open licenses.

In order to support this integration through practice, a key issue is the development of tools for facilitating the expanded documentation of the project. Within the master program, the use of a set of on-line tools is experimented for the creation of a shared repository of resources about the prototyping of interactive systems.

The main tool is the prototype of a web application that features a data entry interface based on four main forms. The forms allow to document the following issues:

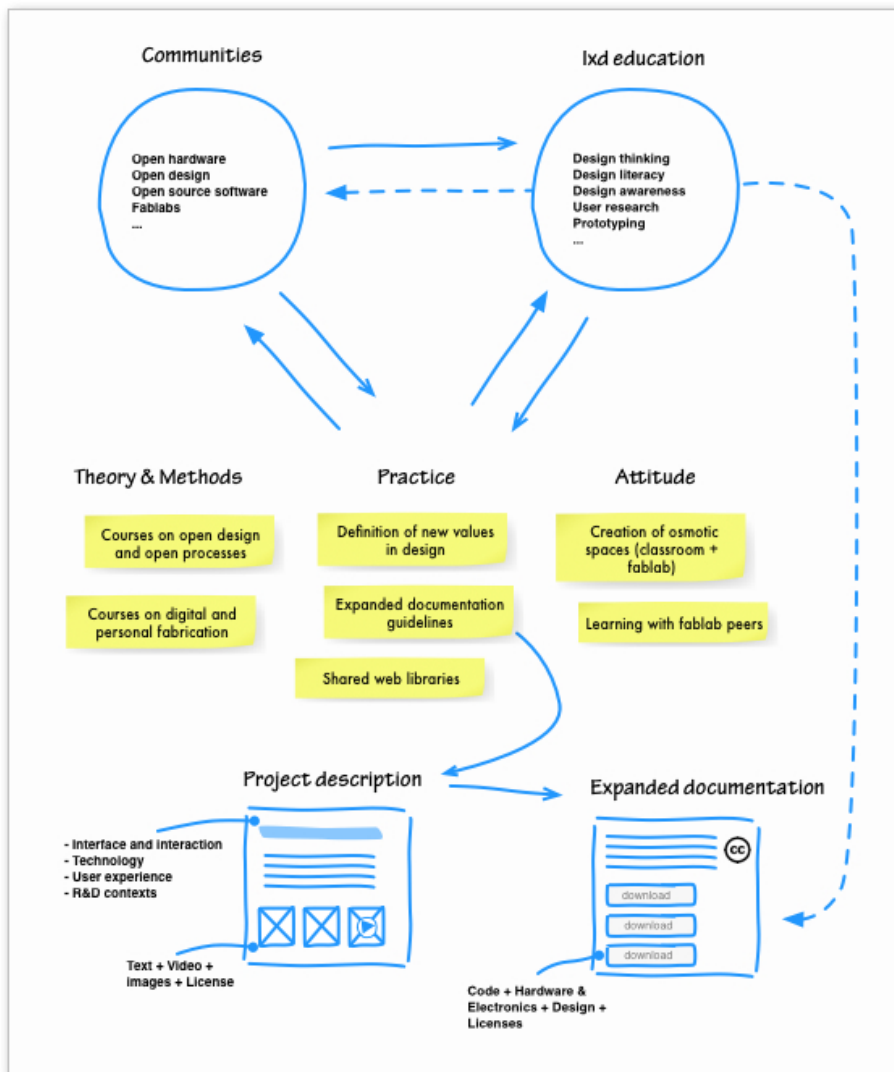
- the general goal and features of the project;
- the hardware and electronics of the project;
- the design of the project;
- the code of the project.

For each project element, students are able to select a specific license, be it Creative Commons or GNU GPL. The use of the on-line documentation tool is also extended in cooperation with already existing platforms for sharing project documentation (github, thingiverse, etc.).



Thanks to documentation guidelines and tools, we aim to fill the gap between the education and community considering the education as a creation of well organized resources for all members.

- **Integration through attitude:** the fabLab at SUPSI in Lugano is a space integrated in the classroom of the master program. The two spaces are also open to local communities for workshops and exhibitions. The creation of these osmotic spaces is a mean for supporting the integration of the master program activities with those typical of a fablab. The integration is based more on the creation of a fablab attitude within the interaction design practice than on the implementation of a self-sufficient fablab.



**Diagram 1.** Model of the integration of open source and fablab practices in Interaction Design Education.

### 3. Challenges and open questions

The process of integrating open source and fablab culture in a interaction design program is open to several challenges and open questions:

- while proposing a set of solutions that can be adopted within other educational contexts, we are aware that reproducibility of the proposed educational system depends on the level of openness of the institution itself. The copyright of students' projects at many universities is a topic already well defined by university regulations (the intellectual property on projects ranges from a 100% on the student's side to a 100% on the university's one, with mixed situations);
- the strong relation between industry and interaction design education generates the necessity for collaborations that are based on a defined business model featuring master courses as means of research and development for the industry. This model may represent a challenge in the implementation of the proposed educational system and requires the definition of new systems that enable this integration;
- the use of open licenses in design is still a topic to be discussed, yet we rather assume that the use of open licenses in the case of students project is a mean of protection and promotion of the project themselves.

The main open question concerns the development of standard documentation guidelines that can be shared with a larger community, potentially worldwide. Standards will allow sharing also tools that can fulfill the needs of such different communities: fablabs, open source community and interaction design education. More research on standard documentation will be developed after the experimental phase of the new educational system at Master of Advanced Studies in Interaction Design.

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- 7 See: PhoneGap, the free and open source framework that allows designery to create mobile apps for different platforms available on the market, <http://phonegap.com/>.
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10. Examples are the Interaction Design Institute of Ivrea ([interactionivrea.org](http://interactionivrea.org), non active since 2005) and CIID Copenhagen Institute of Interaction Design ([ciid.dk](http://ciid.dk)).
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