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# Innovative Labs and Co-Design

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**Abstract.** Since the mid-2000s, new co-design sites began to emerge all over the world. These "equipped environments" are extremely diverse in their forms: 3D conception virtual environments, Fab Labs, Living Labs, co-work spaces etc. Current available tools range from the simplest to the most sophisticated virtual environments through 3D printers. Despite their technological diversities, they share the philosophy of "making" together, which contributes to the emergence of new forms of rationalities for collective action. The objective of this article is to present the conceptual bases that guide the research project on these environments. It is an ongoing partnership project, from French and Brazilian Universities, which will investigate these environments in both countries. The project is focused on the apprehension of these laboratories from the perspective of the co-design of work and life means. These laboratories or design spaces open up possibilities for technical and social innovations by bringing together a diversity of heterogeneous actors.

**Keywords:** Design, Innovation, Work

## 1 Introduction

The innovative labs or "equipped environments" like Fab Labs, Living Labs, co-work spaces and 3D virtual environments will be studied from the perspective of the co-design of work and life means. It is supposed that these environments may contribute to the emergence of new conception and innovation dynamics in the science - society interface. In fact, these environments bear a profound renewal of the collective dynamics engaged in the work and its construction [1]. However, their contribution seems broader due to its openness to non-researchers, who then become legitimate actors in the definition of choices. In addition, new technical mediations favoring collective dynamics are presented by the digital technologies mobilized in these environments, and by the relationships with the situations in the course of design.

Four dimensions of analysis or analyzers are proposed in order to characterize the technical, cognitive and social dynamics that occur in these environments: (i) the "dialogues with the situation" [2], allowed during the design process; (ii) participatory dynamics that are developed [3]; (iii) frontier [4] and intermediate objects [5 and 6] that

## 2 Analysis of cognitive, technical and social dynamics

Without postulating a vision of enchantment with the new co-conception environments, it can be considered that these "equipped environments" can contribute to the emergence of new dynamics of conception and innovation in the science-society interface. In these environments we can observe new technical mediations and collective dynamics involving heterogeneous actors (researchers, engineers, non-researchers, citizens, ...).

In the research project under construction, the proposal is to use four analyzers, interrelated to characterize the cognitive, technical and social dynamics that occur in these co-conception environments.

### 2.1 The reflective conversation with the situation

To design is to follow a drawing, a plan, is to glimpse a change to operate, which brings us back to a "will toward the future". But, in fact, design is to transform the reality that presents resistance that appear in the form of concrete possibilities or impossibilities. Almost all design models put in tension two poles which are of great value to the notion of design and can be described in many different forms such as: (i) the tension between the problem "definition" and the problem "resolution" [ 8], (ii) the tension between the "desirable" and the "possible" [9], and (iii) the tension between the "opportunity to choose" and the "determination" [10], to mention a few examples.

At the heart of these tensions is what D. Schön [2] describes metaphorically as a "dialogue with the situation": the designer pursuing a purpose, projects through his knowledge, his concepts and his values. But the situation "answers". It presents unexpected resistances that can lead the actor to review his representations and to revise his plan and the copy of his drawing. The "dialogue with the situation" can thus take the form of a dialogue that the designer maintains with the graphic sketches or physical mockups he manipulates.

This metaphor of a dialogue with the situation inscribes the project activity in a constructivist epistemology. It postulates that the designer rebuilds in action, knowledge and expertise that are necessary and stresses the importance of socio-technical mediations that occur at the moment of conception.

### 2.2 Participatory dynamic

We just point out that, during the "dialogue with the situation", other actors in addition to the scientific and designers also participate. They are citizens, users, future users and others who may also surprise because of their "answers". Equipped environments have an undeniable impact on participatory dynamics.

Participatory approaches to design and innovation can be briefly recalled here. The late 1990s and early 2000s were essentially marked by an opposition between two streams of participation: the participatory design and the user-centered design [11]. In

user-centered design, these were queried during the design process. This request is justified on technical grounds. The authors show, for example, that the operators' models, manipulated by the designers, are false or erroneous [11].

The purpose of participation is, therefore, to obtain a better result in terms of product. The basis of the participatory conception is quite different, since it considers as a starting point the right of people to directly influence decisions that affect their professional and / or social lives [12]. Since then, the central issue has been Workplace Democracy and empowerment. These two avenues of participation, one aimed at enriching data and better control of its validation, and another, more immediately anchored on social practice does not have the same apprehension of the place and role of the protagonists that will be according to the case the "user" , the "worker" or the "citizen". The co-conception environments are bearers of a double renewal of the dimensions related to participation: the technical and the political (relative to living in collectivity) dimensions.

Despite the differences, both approaches share the same idea: engaging users, workers, citizens and other stakeholders in project decisions that are usually defined without them. The equipped or co-conception environments seem to modify this tendency: the projects that will be conducted can have their origins from questions of the daily life of these users. FabLabs are a representative example of this transformation. These places of citizen engagement and the exchange of information favor the emergence of projects emblematically inscribed in everyday life (of products and consumption) and in the local ecosystem. These new spaces of technical and social innovation make us rethink the "legitimate" principles and actors of "open innovation".

### 2.3 The reflective conversation with the situation

The participatory dynamics that we want to evoke obviously refer to the resources available to the actors to coordinate and, therefore, to the "boundary objects" or "intermediary objects".

These similar concepts emerged from questions relating to the role of objects in social dynamics. The notion of the boundary object introduced by Star and Griesemer [13] points to the articulation between the individual and the collective. These objects maximize both actor autonomy and communication among all. Wenger [14] points out that, thanks to the boundary object, individuals can negotiate their differences and create agreements between different points of view.

When deployed in the field of sociology of science and technology, the boundary object notion receives, above all, an analytical paper. For example, in the works of Dominique Vinck and Alain Jeantet [5] [6] [15], intermediary objects appear mainly as analyzers of the processes through which projects are constructed. The notion of the intermediary object is defined more in "mediation" (the capacity to carry out and guide the course of action) rather than in coordination. It is around the sketches, the plans and the models that the different points of view are coordinated and debated. These concepts highlight the genesis of innovations, the stabilization of socio-technical networks and the construction of translation chains that are made and undone in the work of the innovator(s).

The boundary or intermediary object notions are widespread, to the point of being used to designate all interface device between different knowledge or actors [17]. The mobilization of these concepts seems particularly interesting in the case of equipped environments. In such environments one can witness the emergence of new objects supporting the participatory dynamics.

#### **2.4 The relationship with making**

The equipped and co-conception environments, despite their diversity, can be apprehended from the angle of “making” and “making together”. The intermediary objects just mentioned, designates even the resources that mobilize the actors to do a collective work. However, in these environments, “making” appears as an intrinsically positive value that modifies the relation to the work.

In the first place, in the more open equipped environments emerges a "hacker ethic", a true "work ethic" that renews the protagonists engagement. The aims pursued are transformed, as well as the conditions for implementation, in particular the forms of coordination deployed [18].

The praise of “making” and of “make-it-yourself” is apprehended in response to a lost sense experienced in organizations and, in particular, Taylorist organizations whose origin is related to the division of labor.

To the extent that equipped environments allow action and not only reflection, they are places of experimentation or places favorable to the experience construction and to their collective debate.

### **3 Discussion**

We argue above that equipped and co-conception environments are all characterized by new technical mediations and by renewed collective dynamics among heterogeneous actors. However, Fab Labs, virtual environments, or Living Labs offer a variety of configurations that you can not ignore. As presented, in the project under development, the objective is to understand these environments from the point of view of the design processes and in particular of innovation process. The central idea of these co-conception environments is closely related to open innovation and to effectively consider users as a source of innovation [19].

In addition, these environments lead to a profound transformation in the design protocol. The classical design approaches of the 80s, linear and descendants or top-down, departing from designers to get the use at the end, it doesn't seem to have the best performance. The design dynamics of these equipped environments seem to lie in the continuity of the simultaneous engineering approach, which organized the design process in order to increase the frequency of meetings between the project actors, and this since the beginning. This strategy significantly reduced project time.

In fact, in open innovation, we try to confront as quickly as possible the idea, the concept of the new product to its use. And this is done at a high frequency, through the use of prototypes and other objects that associate users with the product design. In short,

the design protocol here is no longer a descendant one. Rather, it is based on dialogues that are often conducted between design, use, and service provided by the product.

In order to characterize the technical, cognitive and social dynamics in the four dimensions proposed in this article, we intend to use case studies and comparative methods. Three results are expected. The first one is the comprehensive characterization of the diversity of these environments that would allow their comparison. The second is the identification of approaches and methods, based on the design sciences, supporting their use. The third is the documentation of issues related to their extensive incorporation into an economic, cognitive and cultural environment. The hypothesis suggests the need for articulation between these co-design environments and their local ecosystems related to their purposes.

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