

## **Introduction - how to observe an atypical organization?**

This article presents the results of a research in progress – the analysis of the relationship between design and science from the observation of a “residence” with designers and scientists from the French Alternative Energies and Atomic Energy Commission (CEA). "L'atelier des possibles" is a meeting place for researchers, engineers and designers, who explore, for periods of six months, the potential of technological bricks in development. Research teams present to the designers the technologies that they are working on, and ask them to imagine applications and make proposals. In 2009 the Department of Technological Research of CEA, in Grenoble, and the French National School of Industrial Design (ENSCI) in Paris together established this "residence" which gathers design students and researchers each semester.

To describe the “residence”, the discourse of the institutions (ENSCI, CEA) focuses on both the continuity with other teaching methods of the school and the difference with the existing pedagogy. Indeed, the pedagogical context is called "workshop" as other workshops in the school, and it is described as a space of experimentation with matter. "In this residence at CEA in Grenoble, we will be able to imagine the future by relying on the tangible dimension of the "road maps" of technology as we rely on the tangible dimension of wood or metal."<sup>1</sup> At the same time, the relationship between the workshop and the school seems irreconcilable; it has to be set up away from the school. "This “silicon workshop" cannot be installed in the courtyard of the site in Paris: it requires other equipment and knowledge than the ones available in a school of design."<sup>2</sup>

The structure is thus presented as having been created from common sense, and the relationship between scientists and designers follows the growing trend of funding “technology projects based on partnerships between different professional worlds (researchers, technicians, consultants) and disciplines”<sup>3</sup>. This paper wishes to show that collaboration between technological research and design is, in reality, far from being obvious. Technological research works on objects that are not stabilized, on technologies which are said not to be mature yet, but should be stabilized in order to validate, confirm, and ratify the research assumptions. The designers are asked to materialize this knowledge, which is not established, through scenarios, objects and applications. In addition, these proposals, scripts, objects, must then be considered as innovations, ie breaks, changes, novelties. It is precisely for this reason that this residence, "l'atelier des possibles" is a form of atypical organization.

In my research on this organization I was led to ask two questions: How can I watch an organization of this type? How can it be described? We will try to answer these questions by exploring the relationship between two levels of observation: the organizational framework of the residence and the objects produced within this residence. The relationship between these two levels of analysis, and more specifically the relationship between artefacts and organizational frameworks, could provide the basis for a model to describe the “creative cooperation” between actors.

My research is based on a six-month ethnographic observation (January 2013-June 2013) of the actors working within the residence on a project related to augmented reality technologies (IODA project). It

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<sup>1</sup> Extract from the workshop presentation on the website of the school, <http://www.ensci.com/createur-idem>

<sup>3</sup> Verchère, C., Anjembe, E, 2010, « de la difficulté de fabriquer des objets-frontières – le cas d'un projet de conception exploratoire », *Revue d'anthropologie des connaissances*, vol 4, pp.36-64

is also based on a semiotic analysis of objects made by the students during the semester (how they construct meaning, what are the discourses produced about the technologies, their uses, their users, etc.)

In the first part of this article I address the notion of design as it is defined by historians of design in its relation to science, in order to understand issues on which the residence is built. The second part will be devoted to the description of the residence through a double theoretical framework. I will finally propose, in connection with the results of this description, to qualify the objects produced in it.

### **1. Design and Science : State of the art**

The use of the term "design" in Anglo-Saxon countries refers to the idea of conception, but it is always applied to a particular field (engineering design, critical design, etc.). Accepted by the French Academy in 1971, replaced in the meantime, in vain, by "styling", the term "design" struggled to find its definition in the French language<sup>4</sup>. Nevertheless the word has its origins in the Old French "desseing" (1556), which means both drawing and project.

Design historians agree that the design is, in any case, characterized by four elements: it concerns both the form and the function of an object; its objects are manufactured industrially; it is commissioned; and it operates within a context of experimentation<sup>5</sup>. "According to international consensus, we can talk about "design" when it comes to designing an object for industrial production and particularly mass production. "Design" then characterizes the part of creation that in the design of an object (...) ensures coherence between the technical requirements of production, the internal structure of the object, its use-value and its appearance "<sup>6</sup>.

The design seems bound up with the idea of progress, and this is the reason why it can be related to science, or rather what is considered "scientific progress." This is what Joel Gilles recalls, "design" can not be understood apart from the idea of progress. It is its signature. In design progress find its evidence and shape; a project here is actualized in a drawing and a material (aluminum, steel, chrome or stainless steel - glass)." <sup>7</sup> It is this complicity between design and progress that distinguishes design from art. Paul Valéry binds the opposition between art and this "superstition of modernity," this "new barbarism", and relates it to the hatred that the artist develops against the bourgeois. "The manufacture of wonder machines feeds thousands of individuals. But the artist has taken no part in the production of miracles. It stems from science and capital. The bourgeois has invested his money in fantasies and speculates on the ruin of common sense "<sup>8</sup>.

Most of the research on the relationship between science and design distinguishes two main approaches: (1) the first one refers to the project of founding a "science of design", (2) the other sees design as a way to make sense of the results of science ("design for science").

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<sup>4</sup> According to the dictionary *Le Robert*, the term appear in 1959: "Industrial design applied to the search for new forms adapted to their function (for utilitarian objects, furniture, housing in general)." On the contrary, the definition of design by the ICSID, international council of societies of industrial design, is very large and ends like that "design is an activity that involves a wide range of profession in which products, services, graphics , interior design and architecture have a role to play. Together and with other complementary professions, these activities should further emphasize the value of life. Thus the designer has an intellectual activity and not just a job or a service to businesses. "

<sup>5</sup> Barral, J, Gilles, J, (dir), 2007, *Dessein, dessin, design*, publications de l'université de Saint Etienne, Fayolle, C, « qu'est ce que le design aujourd'hui ? » BX arts magazine, 2004, « qu'est-ce que le design » Panton, Verner, Paris CCI, 1969, in Midal, A., *Design l'anthologie 1841-2007*, Editions de la cité du design

<sup>6</sup> Raymond Guidot, « Histoire du Design de 1940 à nos jours »

<sup>7</sup> « Le design, du signe au mythe. Quelques ultimes précisions et ouvertures » Joël Gilles, p.121. And Joel Gilles quotes Boris Vian and his « complainte du progrès : "come and kiss me (Gudule) and I will give you a fridge, a nice scooter, Atomixer, and Dunlopillo, an oven with glass, etc.. " Vian, B., 1955 la complainte du progrès

<sup>8</sup> Valéry, P., 1929, « propos sur le progrès », in *Regards sur le monde actuel*, paris Gallimard, 1945, col. Folio, 1992, p. 139 à 146.

(1) As Nigel Cross recalls, the desire to “science” design appears with the modern movement of the 20s. The desire of method and systematization guides the first attempts to structure design methods. It will take a decisive turn in the 50s, when the Second World War raises new issues. Herbert Simon leads the way in the early 60s to conceptual design methods, which are “a body of intellectually tough, analytic, partly formalizable, partly empirical, teachable doctrine about the design process”<sup>9</sup>. The contribution of structuralism and semiotic studies in the 70s, but also the debate about fundamental epistemological differences between the two sets of practices and knowledge<sup>10</sup> brings along another vision of design. It considers design as an activity that produces discourse, narratives and meaning<sup>11</sup>. The object becomes a sign, a support of expression, and takes on a poetic charge. Researchers such as the designers from the Royal College of Art differentiate between design objects, close to art works and sold in galleries, and artefacts produced by the designer, whose goal is to examine situations in which they are introduced<sup>12</sup>. The latter relates to the breaching experiment defined by ethnomethodology<sup>13</sup>.

(2) The second direction (*Design for Science*) engages a semiotic discussion on how to “represent” or how to “shape” science. The implicit assumption that structures the analysis of the relationship between Design and Science is that the activity of knowledge (epistemology) precedes the activity of symbolization (semiotics), or as Vilem Flusser explains, design, like any cultural production, shows that material does not appear if it is not given a form, in-formed (in the sense of both form *and* information), and once in-formed it begins to appear, to become a phenomenon<sup>14</sup>. « "The first half of the twentieth century was marked by the rapid growth of scientific explanations in many areas, for example, science of materials, engineering science and behavioural science. One way to consider the relationship between design and science is that, through this dependence of design towards scientific knowledge and through the application of scientific knowledge within practical areas, the design “makes science visible”»<sup>15</sup>.

From my perspective, the richness of the relationship between science and design would benefit from finding another model that could reverse this point of view and consider that the activity of symbolization precedes and organizes the activity of knowledge. Such a semiotic approach to design is now being explored by researchers such as Webb Keane<sup>16</sup>, Gary Shank<sup>17</sup>, or Klaus Krippendorff<sup>18</sup> and more recently by the work of our research team<sup>19</sup>.

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<sup>9</sup> Simon, H, 1969, *The Sciences of the artificial*, MIT Press, p.58

<sup>10</sup> « The scientific method is a model that solves problems, that is used to determine the nature of what exists, while the design method is used to invent things that does not exist yet. The scientific method is analytical while the design is constructive» (Gregory, 1966) cité par Nigel Cross, 2007 « le design en tant que discipline », *Designerly ways of knowing*, Dresde, Birkhauser, p123-124

<sup>11</sup> Baudrillard, J. 2005 (1968) *The System of Objects*. Verso Books

Barthes, R., 1957, *Mythologies*, Le Seuil

<sup>12</sup> Anthony Dunne, *Hertzian Tales - Electronic Products, Aesthetic Experience and Critical Design*, Computer Related Design Research Studio Royal College of Art, 1999

Dunne, A. and Raby, F. (2001). *Design Noir: The Secret Life of Electronic Objects*. London/Basel: August/Birkhauser

<sup>13</sup> Garfinkel, H, 1967, *Studies in ethnomethodology*, Prentice-Hall, Englewood Cliffs

<sup>14</sup> Flusser, V., (1993) 2002, *Petite philosophie du design*, Circé

<sup>15</sup> Willem, 1990, cité par Nigel Cross, 2007 « le design en tant que discipline », *Designerly ways of knowing*, Dresde, Birkhauser, p123-124

<sup>16</sup> Keane, Webb. 2003. « Semiotics and the social analysis of material things ». *Language & Communication* 23 (3-4) (juillet): 409-425.

<sup>17</sup> Shank, Gary (2001). *It's Logic in Practice, My Dear Watson: An Imaginary Memoir from Beyond the Grave* [94 paragraphs]. *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research*, 2(1), Art. 9

<sup>18</sup> Krippendorff, Klaus, 2005. *The Semantic Turn: A New Foundation for Design*. CRC Press.

<sup>19</sup> Jutant, Béjean, Gentes, Mivielle, 2013, *Design, meaning making and constructive fixation – Conceptualizing semiotic conditions to the process of designing* 5th International Congress of International Association of Societies of Design Research

Taking stock of these researches, this paper attempts to initiate a descriptive analysis of the points of intersection between design and sciences. It wishes to show that it is always essential to start with understanding how the collaboration between the actors can be both planned and announced as obvious, but also entangled within tensions inherent to its organizational framework. In other words, this article attempts to show that the analysis of the conditions of production of “meaningful worlds”<sup>20</sup> is a prerequisite for any analysis of this type of production.

## 2. The analysis of organizational frameworks

Studying this organization and trying to propose a description led me to explore two models of description, coming out of the sociology of science and interactionism theory. Each model provides a specific point of view on the residence and gives a particular status to it. Each model also determines structural elements that can therefore guide the description. They both provide a communicational point of view on the residence as they see it as a place where circulate representation, knowledge, norms, actors and practices.

The first model takes the institution as a framework. If we consider our organisation as an institution, then the preferred unit of observation is the laboratory, because it is seen as a counterpoint to the school<sup>21</sup>. Following an analysis coming out of the sociology of science, we can try to describe the laboratory, based on models of representation of science that circulate and make sense for the actors who work there. If we now consider our organisation as a stage, a theatre, following the analysis of the American sociologist Erving Goffman, the unit of observation will be the residence as a specific space but also a specific organizational format. The tags in the description will be 1) the “frames” that is to say, the organizing principles that structure the residence, 2) the space, that is to say the physical description of the residence, and 3) the representations, that is to say the mental images of science, design, or collaboration, constructed by the actors.

The interest of such an analysis is that it reveals, for each level of description, that the relationship between science and design is caught in spaces of tension.

Status of the organisation	Unit of observation	Structural elements of the description		
		Institutions	Laboratories	Norms
Theatre	Residence	Framework	Space	Representation

*Methodological summary table*

### First description : « Design in Laboratory»

The first level of description is that of the laboratory. The workshop is presented, for instance on the website of the school, as a space of immersion, positioned at the heart of the laboratories of Minatec in Grenoble.

History of science and research in sociology of science have taught us to look at the laboratory as one of the institutional figures of science. They also taught us to observe the different models of

<sup>20</sup> Goodman, N, 1978, 1992 (trad), *Manières de faire des mondes*, Jacqueline Chambon

<sup>21</sup> "The establishment enables designers (students and post-graduate) at the heart of laboratories working closely with researchers and developers", extract of the workshop presentation on the website of the school <http://www.ensci.com/entreprises/centres-de-recherche/>

representation of science and the relationship between science and laboratory, which are at stake in the discourse of the participants and in the description of the organisation<sup>22</sup>. Each model provides a particular vision of science and describes its characteristics<sup>23</sup>.

For the first model, which considers science as a rational knowledge, the emphasis is on the production of scientific statements, as well as on the relationship between these statements and reality. The second model, which considers science as an area of competition, a "field", as Bourdieu calls it, is interested in how science develops itself and continues to exist. This model is based on a political economy. It studies how knowledge is validated and assessed, but also how scientific projects are financed. As such, this model focuses on the internal organization of scientific fields, and their relationship with the outside. The third model considers science as a set of social and cultural practices. It does not distinguish science from other activities that also produce knowledge. This model is based on the fact that science is a practice anchored in social reality. Finally the model of translation focuses attention on the "inscription" that supports the production of scientific statements and contributes to the circulation of knowledge. In this model, the scientific activity continues outside laboratories.

In our study, the situation of CEA researchers is characterized by a tension between fundamental research and technological innovation, or rather "technology transfer", as evidenced by the presentation of the identity of the French Alternative Energies and Atomic Energy Commission: "a cross-cultural research engineers-researchers, providing a fertile ground for synergies between basic research and technological innovation »<sup>24</sup>. The partnership with ENSCI strengthens this tension and produces a confrontation between the models mentioned above. Scientists generate scientific statements that designers are responsible for exploring and investing, but at the same time, scientists explain to the designers that the issue of their collaboration is to be competitive as evidenced by interviews with researchers: "(this collaboration) allows us to explain to funders that we work on something that does not exist and that there is a real benefit for it". The third model is also explicitly summoned in the political discourse of promotion of the collaboration, which argues for the porosity between the two types of practices. Finally, throughout the workshop process, the researchers demonstrate their commitment and also their concerns about making the designers' artefacts visible within their labs, for the founders, for the industrials, as these objects give evidence to forms of innovation (technical when the object is considered as a demonstrator, social, when the object is regarded as a service).

#### Second description : entanglement of frames and issues

The second level of description looks at the workshop as "residence". It sees how this residence is a production, as in theatre, that is to say an artificial situation that takes place at a specific location and context, that states and orchestrates the encounter between science and design.

The first element of description is space. The residence is characterized by being "outside the walls". It is remote from its mother institution. However, its situation with CEA somehow shows a contradictory injunction: simultaneously being in the proximity of laboratories and being kept away from them. The choice of the physical location of the residence is indeed not trivial. It is located at the very border of CEA, outside its walls, but in its nearest area. This reflects the relationship between a structure characterized by the dimensions of confidentiality, data protection, and boundaries. The effect is that the designers are not at all in conditions of "immersion" in the laboratories. The organization of comings and goings between laboratories and residence is strictly orchestrated - most often the scientists are the ones going to the residence. Yet the issue is important, because the understanding of the scientific community as a place of practice, of standards, and of specific production of knowledge for the designers only operates when they actually visit the teams in their laboratories. There are very

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<sup>22</sup> Latour, Woolgar, 1989, *La vie de Laboratoire, la production des faits scientifiques*, La Découverte

<sup>23</sup> Callon, M., 2006, « Quatre modèles pour décrire la dynamique de la science », in Akrich, M, Callon, M, Latour, B, *Sociologie de la traduction. Textes fondateurs*. Mines Paris, pp.201-251

<sup>24</sup> <http://www.ideas-laboratory.com/index.php/parteneriats/les-partenaires-actuels/cea/>

few opportunities for the designers to make these visits. And yet, the scientific context only becomes meaningful when they are asked not to make noise and not to take photographs, when they are explained what are the security rules and fire prevention on a nuclear site by vocation agents FSL (Local Security Training).

The second element of description is the notion of “frame”. It is used by Erving Goffman to explain how the individual experiences social life. The frame gives meaning to an activity. "Any definition of situation is built on the principles of organization that structure events and our own subjective commitment"<sup>25</sup>. Goffman analyses how a particular activity provided with meaning by a frame can change itself into another activity. He calls "modalisation" the situation when the actors are aware of the change, and he calls “transformation” a situation when there is trickery about the change.

In our study, the residence can be described as an entanglement of several frames. It is an pedagogical framework, as it corresponds to a design educational program for students; but also an organizational framework, in the sense that it is a project; it is also a promotional framework (of a relationship between a school of design and technological innovation), a political framework (for the positive role of design in the relationship between technology and innovation), and finally a strategic framework (the role of CEA as an actor in the French scientific field). Nevertheless there is a common goal which is to produce innovation, but each actor unfolds this objective according to his institutional issues.

This entanglement of frames produces tensions, as evidenced by the ambiguity around the commission, which founds the partnership between students and researchers. If all the actors insist that this is a commission, and as such the workshop "mimicks" the professional world, students themselves point to the fact that the workshop cannot be compared to the professional world. Researchers formulate the commission, but do not re-interfere upon the request, unlike the clients whose goals change throughout the project. The pedagogical team also recognizes that the residence is not a laboratory nor a factory or an agency. Their objective is teaching and as such, the commission is only a pretext to learn how to make design.

This entanglement of frames also creates tensions regarding representations of design, science, technology, but also cooperation, as a model of organization. The entanglement brings together different representations, sometimes contradictory. These representations are accessible in the discourse of respondents, students and scientists.

Regarding the representation of the relationship between science and design, a tension emerges, on the one hand, between a definition of the residence as an “obvious fact of the encounter” between the two fields, and on the other hand, a definition of the residence as an exploration of the unknown, which is far from obvious. The choice of the term "residence" is probably an answer to this contradiction. The residence convokes artistic creation and produces an imaginary representation that makes a parallel between design and art in their relationship to Science<sup>26</sup>. However, the activity of the residence is actually very far from an artistic experimentation. The exploration of the unknown, as it is taught to the students, does not have aesthetic purposes but heuristic ones.

More specifically, with respect to the representations associated with design, on one hand, and science, on the other hand, there is both the feeling of complete ignorance of each other and at the same time the existence of a "already there". Indeed, the designers said they did not know very well scientific practices and do not understand all the technological bricks. Nevertheless they referred to a large number of representations associated with the technologies at stake in the project, particularly

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<sup>25</sup> Goffman, E., 1974, *Frame Analysis, An essay on the organization of experience*, Cambridge, MA: Harvard University Press.

<sup>26</sup> Le Falher, O., 2010, « Mettre en forme le travail artistique : les ressources de l’incertitude dans l’accueil en résidence d’artistes plasticiens », thèse de doctorat en sciences de l’information et de la communication, Université d’Avignon et des Pays de Vaucluse  
Villagordo, E., 2012, « Un sociologue en résidence artistique », *Culture et Musées*, 19

through the production of a movie at the beginning of the project. The recurrence of a debate on the "technophobia" and the ethical posture of the designer toward technology give evidence of this. As for the scientists, all of those we interviewed said they "discovered" design after starting to work with the students. They became aware that the representations they had did not correspond to what they learnt. Thus they often speak about an "unknown world", while in the meantime, all of them project usage and imagine applications for to technologies they develop.

The representation of the designer shifts between two figures, one that transcends the codes, which "will put a kick in the anthill"<sup>27</sup> and one that can adapt to all situations. "The designer does not produce feasible things and it's true that it is not our job to be technical experts. Our job is to stage the technological potential in a way that can be appropriated by the technical teams who will come after. We need to be ambitious and at the same time, pragmatic for someone to pursue the work"<sup>28</sup>.

In reality, the apprehension of foreign universes slowly evolves during the project, as evidenced by the metaphor of "digestion", often mentioned in the discussions.

### **3. Artefacts of the residence: boundary-objects or objects-worlds?**

This last part of the intervention will focus on the relationship between the organizational level, which has just been described, and the level of the artefacts produced by the students. In other words, we want to know whether the tensions described above - confrontation of models of representation of science, staging of the relationship between design and science based on paradoxes (in the walls/outside the walls, evidence/unknown, dissonant Designer / adaptive Designer) - have an effect or not on the production of the designers.

These artefacts crystallize the collaboration between actors. They are almost the only common points between them. They are that on which they agree, negotiate, discuss, ask and answer questions. Whatever the point of view (students, pedagogical team, researchers), whatever the issues (educational, scientific, promotional, political), everybody is waiting for the production of objects.

We indeed observe that there are significant questions about the status of these artefacts. The scientific teams urge students to produce a prototype that reflects how the technology works, "but from a demonstrator, we will have to imagine how could the object be in 10 years". These instructions, relayed by the pedagogical team, are strained between demonstration design and service design, as evidenced by this type of sentences: "It seems that your project is an integration of technological components - You must have a global perspective " (pedagogical team).

If we consider these objects, as they are *a priori* qualified as a shared space between designers and scientists, then we could rely on the "boundary object" conceptualized by Susan Leigh Star and James R. Griesemer<sup>29</sup> and reflected in the work done by Noémie Lesartre about a similar observation<sup>30</sup>.

The work of Star and Griesemer is part of a reflection on the status of the physical object (body,

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<sup>27</sup> Extract of a interview with a student, symposium, Grenoble 10th of april of 2013

<sup>28</sup> intervention of the workshop director between 2009 and 2012, symposium, 10th of april of 2013

<sup>29</sup> Susan L. Star et James R. Griesemer, 1989, « Institutional Ecology, 'Translations', and Boundary Objects: Amateurs and Professionals », *Social Studies of Science*, vol 19, issue 3, pp. 387-420

et aussi Leigh Star Susan, « Ceci n'est pas un objet-frontière ! » *Réflexions sur l'origine d'un concept, Revue d'anthropologie des connaissances*, 2010/1 Vol 4, n° 1, p. 18-35. DOI : 10.3917/rac.009.0018

Trompette P. et Vinck D., « Retour sur la notion d'objet-frontière », *Revue d'anthropologie des connaissances* 2009/1, Vol. 3, n° 1, p. 5-27

Verchère Céline et Anjembe Emmanuel, « De la difficulté de fabriquer des objets-frontières » Le cas d'un projet de conception exploratoire, *Revue d'anthropologie des connaissances*, 2010/1 Vol 4, n° 1, p. 36-64.

<sup>30</sup> Lesartre N., 2012, « Design et recherche technologique au CEA (Grenoble). Rôle du design dans l'émergence de nouveaux objets de coopération », *Cahier de recherche de l'ENSCI - Paris Design Lab ; ENSCI et EPFL / Ecal Lab*, 2009, « Sunny Memories »

artefact, etc..) in social sciences<sup>31</sup>. It explores the strategies of actors that act jointly or cooperate in the absence of consensus. In other words, the authors observe situations, facts and objects. They attempt to understand how the tension between cooperation and heterogeneity is maintained without hindering the action. The criticism of the model of consensus has also been explored by Hans Joas<sup>32</sup>. Joas explains that empirical studies have invalidated the model of bureaucratic rationality: in an organisation, the objectives are often unclear, there are often operative only once specified by the actors. Objectives may change without the existence of the organization being altered. The general objectives can be divided into sub-contradictory objectives. The link between the purpose and the motivation can take very different forms. Thus, the action "is not immediately directed towards clearly defined objectives, according to which the choice of means is made. Most often, however, the ends are relatively indeterminate and are specified by a decision about what means should be used"<sup>33</sup>.

The absence of consensus on the objectives of the residence, or rather the entanglement of the issues and objectives of the different actors, justify the comparison with the analysis of Star and Griesemer.

The boundary objects described by Star and Griesemer, are objects developed by actors in situations of cooperation<sup>34</sup>. Their structure "is sufficiently common to several social worlds to ensure minimum identity in terms of the intersection whilst being sufficiently flexible to adapt to the specific needs and constraints of each of these worlds »<sup>35</sup>. Both authors cite several boundary objects in their study, the "repositories" that allow to organize and index heterogeneity, the "ideal types", which show the descriptive features and allow a generic qualification; "coincident boundaries" that designate different objects that share the same boundaries; "standardized forms" which provide common communication across dispersed work groups.

In this analysis, the boundary objects are actually methodologies, tools that shape the complex reality of interactions, meta-formats which allow to understand the formats that the actors use to build a common reality. They are also, in the case of their study on the natural history museum in Berkeley, considered as a representation of nature. They "represent" ecology. It is on this point that our analysis will differ from that of the boundary object.

Public presentations of students, in front of the scientists teams, are expected to account for a gradual understanding of the world of technology, its integration and its staging. For each presentation, the students present their project and give evidence on the social, economic and political context of their project. They explain the functional relationship that objects produce with technology (whether it is a drawing or a mock-up). The integration of technological components is made explicit as the presentations go on. Moreover, each project unfolds metaphorically spaces and temporalities that depict technology. All the projects are presented with the "mapping of a territory" which situates each project in relation to the others, and in relation to road maps that provide an idea of the project in 1 year, in 10 years. As such, the objects, in their different versions, represent not science but their "relationship" with science.

An example will make things clearer. One of the most commented benefits is the tangibility, the materiality, or the shape of the artefacts. Making a mock-up, giving the possibility to capture, to measure, to touch, produces pleasure, excitement among designers and scientists, which is quite relevant to the importance of physical and carnal relationship in the apprehension of technology.

*"It is important to touch things "(scientific teams - refer to mock-ups).*

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<sup>31</sup> Latour, B, 1988, *Science in Action : How to follow scientists and engineers through society*, Harvard University Press. voir aussi, Julien, M. P., Rosselin, C., 2009, *Le sujet contre les objets... tout contre – Ethnographies de cultures matérielles*, Paris, CTHS

<sup>32</sup> Joas, H., 1999 [1992], *La créativité de l'agir*, Paris, Editions du Cerf

<sup>33</sup> idem, p.165

<sup>34</sup> These objects are considered in their material and symbolic dimension. "An object is something with which people and on which people act. Its materiality comes from action ». Star Susan, L, 2010, idem, p.20

<sup>35</sup> Winck, Trompette, 2009, idem p.8 « Social worlds" mean communities of practice.



« It is a starting point to build with our scientists, allowing them to materialize a number of constraints » (scientific teams)



*Mock-up project IODA, Antoine Berr – mock-up workshop - residence ENSCI Grenoble*

These objects are also creations, they do not represent the technology, they produce it. The production of a particular narrative in every project demonstrates it. Pedagogical teams insist as such, throughout the project, that students "tell stories, work on a topic, imagine a scenario " (pedagogical team). These stories are not fairy tales, however they produce situations that do not exist yet. These stories tell a day-by-day that people could live or have already lived in dreams. Each of these projects makes a world that relies on a set of memories, emotions, references to very specific environments. The reactions of the scientific teams are thus very interesting as well and show that the real issue is not strictly a technological demonstration, but the production of a world in which technology can acquire meaning.

This example thus examines the relationship between design, science and progress. The residence is a place that provides a representation of a form of "innovation by design", which is not asserted as such. The process of design is expected to reveal a field of technological possibilities. As such, designers ceaselessly orchestrate surprise. They let appear what is new through imagining the possible worlds that technology will be able to create. However, the injunction for technological transfer implies a certain definition of innovation (progress as affirmation of novelty thanks to the quantitative increasing of knowledge and expertise). This novelty is not founded on difference but repetition; it is opposed to a certain conception of innovation that would less rely on the intrinsic quality of technology than on the collective capacity of social agents to confer them meaning<sup>36</sup>.

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<sup>36</sup> Alter, N, 2000, *l'innovation ordinaire*, PUF