

## Andreas Broeckmann

### The committee of scientific advisors of *Les Immatériaux*

Summary: This text focuses on the work done with a group of scientific advisors, including the chemist and science theoretician Paul Caro, the astrophysicist Michel Cassé, computer scientist Mario Borillo, the mathematician Pierre Rosenstiehl, and the micro-biologist Jean-Pierre Raynaud. In a series of seminal meetings, Lyotard and Chaput attempted to ascertain the state of debates about different aspects of materiality, in different scientific disciplines. From these debates and transdisciplinary perspectives grew not only a more thorough understanding about what Lyotard had, in 1979, described in a more cursory fashion, as the *postmodern condition*, but they elicited also concrete proposals for specific exhibits. Notably Paul Caro and Michel Cassé can be identified as the authors of certain exhibition sites, some of which were realised in a dialogue between the scientists and the project managers in Chaput's team. Special attention will also be paid to the philosopher and life science theorist Michel Tibon-Cornillot who advised Lyotard and Chaput extensively. Even though his input left few immediately discernible traces in the exhibition itself, his thinking had a lasting impact on the way in which Lyotard framed his discourse on the relation between matter and life.

### The scientific committee

On 20 November 1983, while Jean-François Lyotard was still in the United States for his fall teaching assignment, his co-curator Thierry Chaput sent him a handwritten fax message in which Chaput reported about the latest progress on preparations for an information brochure that would announce the planned exhibition. Chaput also informed Lyotard about a meeting envisaged for 19 December, after his return to Paris, with some distinguished scientific advisors ("*tout nos conseilles*").<sup>1</sup> This meeting would be the first in a sequence of six such encounters, which took place in the course of the following six months. The invited scientists were the chemist and science theoretician Paul Caro, the astrophysicist Michel Cassé, the mathematician Pierre Rosenstiehl, the micro-biologist Jean-Pierre Raynaud, and the computer scientist Mario Borillo.<sup>2</sup>

In an interview conducted a year later, shortly before the exhibition opening, Lyotard would explain the purpose of these "consultations that we carried out for the preparation of the exhibition, with a whole scientific committee with which I tried to update myself as regards the question of the established knowledge."<sup>3</sup> The contemporary status of scientific knowledge had been the key question of a report that Lyotard had published in 1979, under the title of *La condition postmoderne (The Postmodern Condition, Engl. ed. 1984)*. This seminal text, in which Lyotard formulated the hypothesis of the end of the modernist "grand narratives" of enlightenment and emancipation, not only sparked an international debate about the foundations of the "postmodern condition" of knowledge that Lyotard had diagnosed. This influential text was also one of the reasons why Lyotard was first invited by the Centre Pompidou to help conceptualize and curate the exhibition that would open as *Les Immatériaux* in the spring of 1985.

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<sup>1</sup> 1994033W667\_009. The mentioned brochure would eventually be ready for distribution in April 1984.

<sup>2</sup> Caro, Cassé and Borillo participated in all six meetings, while Raynaud and Rosenstiehl missed some of the sessions. Only Borillo was not mentioned in Chaput's fax message of 20 November which had yet announced the computer scientist Jean-Louis Laurière as a prospective participant – who however, for unknown reasons, never participated. Laurière (1945–2005) was a pioneer of artificial intelligence and expert systems, based at the Université Pierre-et-Marie-Curie in Paris until 1987.

<sup>3</sup> Lyotard/Blistène, *Flash Art*, French edition, p. 28 (transl. AB).

The question of knowledge thus formed part of the foundations of the project that Lyotard and Chaput together ventured into in the summer of 1983, and it gave the discussions with the scientific advisors a particularly important position in the complex variety of preparatory measures conducted all through 1984. In fact, these meetings confirmed for Lyotard what had only been a suspicion in 1979. In the interview quoted earlier, he says: "What strikes me, and I must say particularly thanks to the meetings and consultations [...] with a whole scientific committee with which I tried to bring myself up to date as regards the question of established knowledge, is that precisely this established knowledge does not exist."<sup>4</sup> Instead, Lyotard took from those discussions the impression that contemporary scientists were consciously and self-critically dealing with the various degrees of uncertainty and non-knowledge, through elaborate methodologies of experimentation, speculation and fabulation.

Besides such science-theoretical insights, the work with the scientific advisors led to a series of concrete proposals which were, in a significant number of cases, realized as parts of the exhibition. Of the total of circa sixty exhibition sites in *Les Immatériaux*, around thirteen sites, that is more than a fifth, can be more or less directly connected to conversations with, and proposals made by, the scientific advisors. We will look at these sites in greater detail, after taking a more general look at the proceedings of the scientific committee.<sup>5</sup>

### The meetings of the scientific committee and their participants

The six meetings with the scientific advisors took place in a monthly rhythm, starting on 19 December 1983, and continuing on 24 January 1984, 24 February, 20 March, 24 April, and 14 May.<sup>6</sup> The five protagonists – Mario Borillo (1934–2013), Paul Caro (1934–2016), Michel Cassé (born 1943), Jean-Pierre Raynaud (\*\*\*), and Pierre Rosenstiehl (1933–2020) – were all men, aged between forty and fifty, they worked at Paris-based academic and research institutions and they were all known for not only their scientific specializations, but also for their interest in science theory, and the role of science in society. They actively engaged in the committee's proceedings during the first half of 1984 – if to varying degrees, as we shall see shortly –, and they also joined the collaborative writing experiment of *Epreuves d'écriture* that Chaput, Lyotard and their team conducted during the autumn months of 1984, making the participants co-authors of the conceptual volume in the three-part exhibition catalogue.<sup>7</sup>

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<sup>4</sup> Lyotard/Blistène, *Flash Art*, French edition, p. 28 (transl. AB). (*En fait, ce qui me frappe, et je dois dire tout particulièrement grâce aux rencontres et aux consultations que nous avons réalisées pour la préparation de l'exposition, avec tout un comité scientifique avec lequel j'ai tenté de me remettre à jour en ce qui concerne la question du savoir constitué, c'est que justement ce savoir constitué n'existe pas.*)

<sup>5</sup> The main archival sources for the following analysis are the minutes of the meetings of the advisory committee, as well as the archived proposals which the scientists drafted in preparation of the meetings. Additional information is taken from the *Inventaire* exhibition catalogue which gives indications of how the respective sites were realized, and from handwritten notes taken by the project managers on Chaput's team, especially Martine Moinot and Sabine Vigoureux.

<sup>6</sup> Whether another meeting took place on 19.7.1984 could not yet be ascertained. There are minutes for all of these meetings, besides those on 24.1. and 19.7.. There is little reason to doubt that the meeting on 24 January (cal. Moinot, "réunion Matériaux") actually took place: the entries for the following meetings in Moinot's calendar are similarly general (24.2. "États généraux"; 20.03., "Réunion générale"), and there are concept notes prepared for the meeting on 24.1.1984. by Borillo, Caro, Cassé, and Raynaud (1994033W666\_005 through\_008). In contrast, there is so far no evidence of the meeting on 19.7., other than the announcement in the minutes of the 14.5. meeting, and an entry in Moinot's calendar ("conseil scientifique").

<sup>7</sup> Only Jean-Pierre Raynaud did not participate in the *Epreuves* project. See Working Paper No. 7: Andreas Broeckmann: "On Epreuves d'écriture, the collaborative writing project of Les Immatériaux" (2021).

The committee meetings were joined not only by Lyotard and Chaput, but also by their team of project managers (Martine Moinot, Catherine Testanière, Nicole Toutcheff, Sabine Vigoureux), the catalogue editor Chantal Noël, and audiovisual producer Martine Castro, the number of participants growing from nine in the December meeting, to thirteen in May. According to the minutes, the contributions came most predominantly from Lyotard and the scientists, putting the team members in the position of listeners who were learning, like and with Lyotard, about the epistemological context within which the *Immatériaux* project was evolving.

At the beginning of the first meeting, Lyotard formulated the dual assignment for the scientific dimension of the exhibition, and thus also for the work of the scientific committee. He called the exhibition, first,

"a site of confrontation where properly scientific *dispositifs* rub shoulders with others, technological, artistic, etc."

and second,

"a site of anamnesis where science would compare itself to itself in order to underline the evolution of fundamental concepts, of the nature of hypotheses, of the use of devices, and thus to highlight the change of paradigms."<sup>8</sup>

We see, at this early stage of the conceptual exploration, already the two sides of the approach taken by Lyotard and Chaput throughout the exhibition: on the one hand a more affirmative approach that seeks to expose and confront recent technical, scientific and artistic phenomena, and on the other hand an approach that is reflexive, critical and confrontational.

The following two meetings served the joint orientation in the broad discursive field that Lyotard hoped to address, moving from a general discussion in January of possible topics and keywords,<sup>9</sup> to the presentation by the scientists of initial proposals for exhibits, put forward four weeks later in the February meeting.<sup>10</sup>

The meeting of the scientific advisory committee on 20 March 1984 then stands out – as far as one can tell from the summary in the minutes – in that it combined more theoretical considerations with a debate about how to translate these into exhibition sites that would make the intricate science-theoretical ideas understandable for a lay audience. Afterwards, the

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<sup>8</sup> 1994033W666\_001, p.2 [1. *Site de confrontation où des dispositifs proprement scientifiques en côtoient d'autres, technologiques, artistiques, etc. ... 2. Site d'anamnèse où la science se comparerait à elle même afin de souligner l'évolution de concepts fondamentaux, de nature d'hypothèses, d'usage d'appareils, et mettre ainsi en évidence le basculement des paradigmes.*]

<sup>9</sup> At the end of the December meeting, Lyotard requested from the scientists, for the next meeting, the formulation of ten keywords or phrases that they regarded as important starting points ("*dix mots clés (ou phrases) qui développent les problèmes posés dans le dossier et abordés au cours de cette première réunion.*" 1994033W666\_001, p.3) There appear to be no minutes for the meeting on 24 January, but there are lists of keywords and preparatory notes by Borillo (dated 20.1.1984, 1994033W666\_008), Caro (n.d., 1994033W666\_006), Cassé (dated 23.1.1984, 1994033W666\_005), and Raynaud (dated 23.1.1984, 1994033W666\_007).

<sup>10</sup> See the minutes of 24.2. 1994033W666\_002.

meetings in April and May were increasingly dedicated to the state of planning of the overall exhibition, and to discussions of practical matters regarding the realisation of the proposed sites which were then pursued further in individual meetings with the advisors.<sup>11</sup>

In contrast, the archival documents suggest that the founding idea of the scientific committee was most accomplished in the meeting on 20 March, namely to bring together different scientific and methodological perspectives in an interdisciplinary dialogue, with the aim of configuring contributions to a public exhibition. Sparked by a review of the proposals by Caro and Cassé there emerged a discussion of different conceptions of time, an episode that pinpointed the interdisciplinary momentum of this conversation between scientists and philosopher.<sup>12</sup> Similarly, and immediately following this discussion on time, the astrophysicist Cassé introduced a proposal for a site which would deal with the magnetic field of stars and the forces of matter and anti-matter, to which the microbiologist Raynaud responded with the observation "that a parallel could be made with the NMR [Nuclear Magnetic Resonance] imaging of the cellular space. From the core of the star to the core of the cell, visual implementation of the excitation of magnetic fields of matter."<sup>13</sup> Such a juxtaposition of macro and micro phenomena highlighted the common epistemological framework within which contemporary sciences were operating, emphasizing the relational forces and energy flows over material particularities.

Only a little while later, the conversation moved to the theme of visibility and invisibility, first introduced by Michel Cassé who spoke about how knowledge was determined by perception, and how a technically assisted and augmented scientific gaze broadened the range of what could be perceived, and known. The minutes report that "Lyotard thinks [...] that [such a site] can be interesting as a concrete illustration of a site of the capture of the message."<sup>14</sup> Lyotard here translated the scientific question of knowledge and visibility onto the field of semiotics which was so crucial for his own thinking, and for the epistemology of *Les Immatériaux*: only the message whose code is legible and which can be registered within a matrix of knowledge, enters into the field of sensing and reasoning. By technical means, the range of such registration and legibility can be extended beyond the boundaries of a given perceptual apparatus.

It must have been in moments like these when the conversations with the scientific advisors were most fruitful for Lyotard and Chaput, because they manifested how theory, science, technology and art were conceptually entangled, and how this entanglement could be articulated – or at least gestured towards – in the presentation of specific phenomena and items in the exhibition.

### Site proposals by Paul Caro

As far as we can tell from the archival materials, the contributions and proposals made by the various scientific advisors differed significantly. Borillo, Caro and Cassé participated in all

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<sup>11</sup> See the minutes of the meeting on 24 April, 1994033W666\_012, and 14 May, 1994033W666\_013; see also Sabine Vigoureux's handwritten notes, 1994033W232\_002\_f.

<sup>12</sup> See 1994033W666\_009, p. 3.

<sup>13</sup> 1994033W666\_009, p. 3 (*M. Raynaud observe qu'on pourrait faire un parallèle avec l'imagerie RMN de l'espace cellulaire. Du coeur de l'étoile au coeur de la cellule, mis en oeuvre visuelle de l'excitation des champs magnétiques de la matière.*)

<sup>14</sup> 1994033W666\_009, p. 3 (*M. Lyotard pense [...] qu'il peut être intéressant comme illustrant concrètement un site de capture du message.*)

six meetings, while Raynaud and Rosenstiehl missed several of them. In the minutes, the first names also appear frequently, while the latter are mentioned much less, suggesting their uneven engagement in the discussions. And while we have only vague hints at the concrete suggestions made by Borillo and Rosenstiehl, and some general keywords for those of Raynaud, the proposals by Caro and Cassé were discussed at length during the various meetings.<sup>15</sup> Moreover, Paul Caro was the only one to prepare typed documents for four of the six meetings, providing conceptual considerations and scenographic ideas. Caro thus flagged a heightened interest, and made it possible to discuss concrete proposals and their technical realizations.

We will here first turn to Caro's proposals, not least because they offer further insights into how the suggestions were taken up by the curatorial team, and then developed into concrete plans for specific exhibition sites. These more general findings will then be complemented with regard to the proposals made by the other advisors.

Paul Caro studied chemistry and became a specialist in rare earth elements in the 1950s.<sup>16</sup> He went on to research, first in the United States and later back in France, their chemical and physical properties using a broad range of experimental tools, including electron microscopy, high-resolution spectrography, and theoretical methods derived from quantum atomic spectroscopy. In addition to this interest in scientific instruments and methods, Caro developed an expertise in science education, participating in research and communication activities of the European Community, as well as serving as an advisor for the Cité des sciences et de l'industrie at La Villette in Paris.<sup>17</sup>

The proposals that Paul Caro made for *Les Immatériaux* were all intended to illustrate a number of basic principles of physics and mathematics that articulated the epistemological shift encapsulated in Lyotard's concept of the "immaterials."<sup>18</sup> Several of these proposals were first put forward in the form of a conceptual sketch for the February meeting, and then refined in the documents which Caro prepared for the following reunions. Thus, the first proposal for what would eventually become the site *Indiscernables*, was formulated in February as a short explication of the mathematical principle of permutation, under the title of "*Les permutations*." Then for the March meeting a revision of this explanation was supplemented by a total of seven suggestions for alternative ways to realise the principle in the exhibition, one of which included the suggestion to work with various uniforms of policemen, nurses, et cetera, an idea that would get taken up and developed for the site in which, a year later, the outfits of a policeman, a surgeon and a chef were suspended in adjacent niches formed by

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<sup>15</sup> This imbalance is partly an effect of the disparate archival situation; for instance, there are additional handwritten notes by Vigoureux of a separate meeting with Cassé on 19 April 1984 (1994033W232\_002\_b), but not of a similar meeting with Raynaud, presumably on 5 March. The uneven coverage in the minutes could, at least in theory, also be based on a certain bias on the part of the minute authors.

<sup>16</sup> See Paul Caro: Interview by Bernadette Bensaude-Vincent and José Gomes, Paris, 2002 ([https://authors.library.caltech.edu/5456/1/hrst.mit.edu/hrs/materials/public/Caro/Caro\\_interview.htm](https://authors.library.caltech.edu/5456/1/hrst.mit.edu/hrs/materials/public/Caro/Caro_interview.htm); accessed 25 Nov 2022); Paul Caro: Déplacement des terres rares et de l'yttrium de leurs halogénures par le magnésium; Préparation et étude des alliages magnésium-yttrium. Paris: Masson, 1964. In: *Annales de chimie*. Sér. 13, T. 9.1964.

<sup>17</sup> Caro's first question, in the first meeting of the scientific advisory board, was about the way in which the audience would be addressed; he suggested that the visitors should not feel misused or aggressively forced (1994033W666\_001, p.1).

<sup>18</sup> See Caro's introduction to the set of proposals submitted on 20 March 1984, 1994033W666\_010, p.1. The other two key documents are his proposals of 24 February (1994033W666\_003) and 24 April (1994033W666\_013).

large mirrors, with overhead spotlights that were switched on and off to indicate changing constellations (permutations) between the three social actors.

A similar path led to the conception of the site *Jeu d'échecs*, a room-size installation with a large checkerboard floor on which the visitors could move around, being illuminated and thus "made visible" whenever their position coincided with the position of a figure in a virtual game of chess played by a chess computer which controlled the switching of the overhead spotlights. In February, Caro proposed that one of the sites should deal with "the mathematical matrix" (*La matrice mathématique*), and in March refined this, in a text entitled *La matrice*, into an idea coming close to what would become the eventual realization of *Jeu d'échecs*. During the discussion, Borillo demurs that the rules of chess might be too complicated and that the procedural model should rather be that of the game of draughts (*jeu de dames*) – an intervention which led to the site being called "*jeu de dames*" in the comprehensive overview document that Chaput and Lyotard prepared for the Centre Pompidou presidency in April 1984. In Caro's explanatory document prepared for the meeting on 24 April, however, he insistently calls it *Site de "l'échiquier"*, a formulation that will be modified to *Jeu d'échecs* later in the preparation process.

A proposal by Caro's that stands out for the elaborate production it elicited, led to the site which was eventually presented as *Irreprésentable*. It consisted of a small forest of plants, placed in a large tub and representing the complexity of a natural living system. Positioned in this environment was an apparatus in the form of an open cubic structure just under a square meter in size, with specific red neon lights turned towards its inside where a potted plant was thus growing under optimal light conditions which differed from the lighting conditions in the rest of the environment. This "phytotron," this engine of plant growth, was complemented with a hydrometer taking measurements, and a text display about the complexity of systems that cannot be represented or explained within the limited dimensions available to human comprehension. – This latter argument had first been put forward by Paul Caro already in February, under the header of "complexity" (*La complexité*), which by April took on a more refined conceptual framing, pinpointing what cannot be represented adequately, "*irreprésentables (ou complexité, ou dimensionnalité)*."

An archival dossier of fifteen pages in which project manager Martine Moinot collected the documents and notes related to the realisation of this project, documents how Moinot, in the period from June 1984 till January 1985, gradually put together the elements that would make up the installation.<sup>19</sup> There are lists of names and phone numbers which were presumably assembled in meetings with Caro and others, indicating a trail of conversations and references from one person to another. On a page dated at the end of August, the name Pavlides appears, and it would be Dimitri Pavlides, a researcher working for the national research institute CNRS at the Phytotron in Gif-sur-Yvette, who provided the crucial information for how to construct the phytotron. In a letter sent to Moinot at the beginning of November, Pavlides gave a technical description, including a drawing with precise measurements, which Moinot could pass on to the exhibition architect and the technical service of the Centre Pompidou. And the dossier also contains a letter by Pavlides' superior, dated in January 1985, instructing Chaput and Moinot where and at what price to buy the materials required to fill the planting tub and to keep the plants alive during the exhibition period.<sup>20</sup>

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<sup>19</sup> See 1994033W223\_023.

<sup>20</sup> For the Phytotron in Gif-sur-Yvette, see the film documentation *Le Phytotron* (1969) (<https://images.cnrs.fr/en/video/1342>; accessed 25 Nov 2022). The Argentinian biologist and cyberneticist Luis Benedit constructed an artificial habitat for bees in the 1960s which he presented first under the title of *Biotron* (1970), and then as *Phytotron*, at the Museum of Modern Art, MOMA New York, in 1972, and at the contemporary art center CAYC in Buenos Aires, in 1973-1975. (I'm grateful to Lena Trüper for pointing out this

The case of the site *Irreprésentable* shows how the conceptualization of a particular exhibition site was the result of research trajectories which Lyotard and Chaput would have been informed about by Caro and Moinot, but which went beyond the capacities for individual decision-making of the curators. Rather, the research ran its course and received its impulses from a variety of actors, only some of whom would be mentioned by name. For reasons that we can only speculate about, Pavlides, in his letter to Moinot, explicitly specified that he did not want to be mentioned as the author of the "simulator": he wanted the device to be presented "without mentioning the origin" of the design ("*sans indication d'origine, s.v.p.*").

In the exhibition, five of the seven sites proposed by Caro were clustered together in a central area of the gallery: *Surface introuvable*, *Indiscernables*, *Matricule*, *Variables cachées*, and *Irreprésentable*, whereas *Petits invisibles* and *Espace réciproque* were presented elsewhere in the show. Two of the clustered set, *Variables cachées* (whose first version was introduced in February as "a psychological experiment", *Une expérience psychologique*), and *Matricule* (first conceptualised with respect to the mathematical principle of partitions, *Les Partitions*, and then running under the working title of "Jackpot" for several months), explicated the dialectics between individual and society, between numbers that identify (*Matricule*) and numbers that become meaningful as part of large statistical data sets (*Variables cachées*).

Caro brought three new proposals for sites to the meeting on 24 April 1984, namely for the sites that would become *Petits invisibles*, *Espace réciproque* and *Surface introuvable*.<sup>21</sup> Caro made these proposals after several discussions of the advisory committee, and after weeks of reflexion, which indicates that these are either ideas that only came to him later, or they emerged more directly from the committee proceedings in the previous months.<sup>22</sup> The proposal for *Espace réciproque* ("La Transformation") was based on the phenomenon called Fourier transform, which can serve to visualize the internal atomic structure of a material by means of a laser. Its presentation in the exhibition is badly documented and appears to have been rather enigmatic. In contrast, Caro's suggestion for *Surface introuvable* – first entitled "La Surface (support du message)" – led to one of the clearest renditions in the entire show of the concept of the "immaterials" as a general state of uncertainty which affected the visitors in their encounters with materials and things in the everyday world. A standard map of France was displayed next to a sheet of paper of the same size, juxtaposed with a relief map of the same French metropolitan territory on one side, and with several microscopic photographs showing unusually detailed aspects of the same paper material on the other. The site illustrated that a "surface" could not be taken for granted, and that the perception of a certain material depends crucially on the scale at which it is observed.

An clear case of a proposal resulting from conversations in the scientific advisory committee meetings, is one that Caro initially called "Site of 'light'" (*Site de la "lumière"*), and which was also discussed under the title of "All the colours (or Little Invisibles)" (*toutes les couleurs [ou petits invisibles]*). Caro's proposal was based on an idea that Lyotard first put to Cassé in February, as part of a whole list of themes for which Lyotard requested proposals from Cassé who had first introduced the theme of visibility and invisibility to the

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historical precedent of which, possibly, neither Caro nor Pavlides were aware. An analysis of Caro's relation with cybernetics, both in his scientific work and in the proposals he made for *Les Immatériaux*, is pending.)

<sup>21</sup> See 1994033W666\_013, *Petits invisibles*, "Site de la 'lumière'", p. 5; *Espace réciproque*, "La Transformation", p. 7; "La Surface", p. 8.

<sup>22</sup> The proposal for "Site de la 'lumière'/toutes les couleurs/Petits invisibles", and the updated version of "Site de 'l'échiquier'/Jeu d'échec" are typed with a different typewriter than the one otherwise used by Caro, and both include unusually precise technical drawings, suggesting that Caro perhaps developed these versions together with somebody else.

conversation. In that situation in February, Caro immediately responded to Lyotard with an observation,<sup>23</sup> and during the meeting in March, Caro developed the idea further: "Monsieur Caro, taking up the theme of the visual spectrum, proposes to present a piece that, according to the light which would illuminate it (wide or narrow monochromatic band), would allow to see different things."<sup>24</sup> He brings a written concept for the site to the meeting in April, and further elaborates in the next meeting, three weeks later: "in this site [...] the visitor would experience different types of light (infrared, ultraviolet, white light), and therefore [different types] of perception."<sup>25</sup>

We recognize in Paul Caro a member of the scientific advisory committee who not only contributes his knowledge and theoretical reflexions, but who also actively engages with the challenges and opportunities offered by the format of the public exhibition. He represents a genuinely open and communicative attitude that pushes forward on his own fields of expertise, but that also integrates other ideas and thus fuels the overall project.<sup>26</sup>

### Michel Cassé

Compared to Caro who actively participated in the proceedings of the advisory committee and who can be regarded as the main author of seven exhibition sites, the astrophysicist Michel Cassé was similarly vocal during the meetings with the scientific advisors, and clearly discernible in the publications and archival documents as somebody who had a crucial impact on the way in which Lyotard conceptualized the "immaterials". Yet, of his various proposals, only the site *Creusets stellaires* was realized in the exhibition. The installation combined projected images of galaxies and stars with a text by Cassé that narrated the development of the universe since the Big Bang in the style of a myth of origin.

Other ideas for sites that Cassé put forward proved technically impossible to realize, or they did not get beyond the draft stage. Only his suggestions for a twin site that would have dealt with the visibility of the universe and of the Earth – both represented by live-images from satellites in orbit – were part of the curatorial discussions throughout 1984 and formed important conceptual points of reference during this preparatory phase, even if they were not realized in the end.<sup>27</sup>

Michel Cassé is a French astrophysicist with a particular interest in the origin and evolution of elements and stars in the universe, in cosmic radiation, supernovae, and cosmology. His books deal with the invisible, with the void, and eternity. He worked at the Institute of Nuclear Energy, CEA, and at the Institute of Astrophysics in Paris. In 1983, Cassé had contributed to the catalogue of an exhibition about space organized by the Centre de Création

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<sup>23</sup> See 1994033W666\_002, p. 3.

<sup>24</sup> 1994033W666\_009 (*M. Caro reprenant le thème du spectre visuel propose de présenter une pièce qui, selon la lumière (bande large ou étroite monochromatique) qui l'éclairerait, donnerait à voir des choses différentes.*)

<sup>25</sup> 1994033W666\_013, p. 3 (*dans ce site [...] le visiteur expérimenterait différents types de lumières (infrarouge, ultraviolet, lumière blanche), et donc de perception.*)

<sup>26</sup> Another proposal that Caro put forward in February and extended in March, under the working title *La Commutativité (ou les Incommutables)*, was not realized, however the proposed discourse on time and sequence formed part of a broader discussion of recurring themes and perhaps found an echo in sites like *Temps différé*, and *Vite-habillé*.

<sup>27</sup> The two sites *Grands invisibles, soleil* and *Grands invisibles, terre* were mentioned in a summary document in April 1984, they appear in a draft exhibition plan by the scenographer Philippe Délis in September (2009012W006), and an entry for *Grands invisibles* is present in Lyotard's drafts for the catalogue texts, written in December 1984 (1994033W666\_033).

Industrielle at the Centre Pompidou, and Cassé had published longer articles about astronomie in the popular science magazine *Ciel et Espace*, and in the daily newspaper *Le Monde*.<sup>28</sup>

The minutes of the various meetings in which Cassé took part show how, again and again, he effortlessly connected general scientific topics with the most visionary ideas about the birth of the universe and cosmic events on the grandest possible scale, in both space and time. During the February meeting of the scientific advisory committee, Lyotard ventured into giving a long list of themes for which he asked Cassé to develop proposals for exhibition sites. At a moment when Caro was already making quite concrete suggestions, Lyotard was yet encouraging Cassé to consider:

- a site about the visible (on the rapport between the human eye and the eye of astronomy);
- a site about observable matter which is only a tiny part of the visible;<sup>29</sup>
- a site about matter and code with regard to the theory of relativity, and quantum theory;
- a site about the theory of the Big Bang as a narrative of origin and creation;
- a site about the notion of proof, and how it relates to power and truth;
- a site about the life of stars and the propagation of cosmic materials.<sup>30</sup>

This list probably shows, more than anything, how inspiring Cassé's discourse was for Lyotard. – In that situation in February, Cassé himself appears to have responded only to the last suggestion which he commented on, according to the minutes, with a remark about the notion of a "sociology of stars" which he had been promoting for some time.

For the meeting in March, Cassé brought back ideas for three sites, namely about the "discourses on the origins", on the "astronomie of the invisible", and on the "life and work of the stars."<sup>31</sup> But it seems that in the following weeks neither Cassé nor Lyotard and Chaput and their team were able to translate these ideas into concrete, manageable proposals. The project of a live-transmission of satellite images for *Grands invisibles* proved technically and financially impossible, the plan of a film project about space-time and the deformation of space under the influence of matter was mentioned only in the May meeting, and the other two proposals which were made in March and which included ideas like the registration of visitors' emotions, or presenting a piece of a star to illustrate the principles of matter and anti-

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<sup>28</sup> The scientific concept of *Creusets stellaires* was developed by Cassé in cooperation with the astrophysicist Jean-Pierre Bibring. Both Bibring and Cassé had contributed texts to the exhibition catalogue *Au Temps de l'espace*, CCI, Centre Georges Pompidou, curated by Jean-Paul Pigeat, 1983: Jean-Pierre Bibring, "La Terre vue du ciel," (p. 23), and Michel Cassé, "Transcendence de la vision," (p. 25). Excerpts of texts by Cassé about void, and about anti-matter, were collected during the preparation of the *Immatériaux* exhibiton in a dossier, 1994033W666\_011, which included M. Cassé, "Astronomie de l'invisible", *Ciel et Espace*, No. 193, May-June 1983, 37–40; "L'astronomie en révolution", three parts, *Le Monde*, 26–28 July 1983. See also Cassé's later publications, Jean Audouze, Jean-Claude Carrière, Michel Cassé: *Conversations sur l'invisible*, 1988; and Michel Cassé: *Du vide et de l'éternité*, 2014.

<sup>29</sup> This is where Caro jumped in and spoke about the differentiated visibility of colours, and how certain phenomena could be made visible by new technologies; a related site dealing with the "colour codes of an invisible world made perceivable" (p. 4), would be proposed by Caro in April and would eventually be realised as *Petits invisibles*.

<sup>30</sup> 1994033W666\_002, p. 3–4.

<sup>31</sup> 1994033W666\_009, p. 3.

matter, – these proposals also stalled, leaving in the end only the audiovisual display and narrative of *Creusets stellaires* as Cassé's practical contribution to the exhibition.<sup>32</sup>

But Cassé's role, it seems, was less that of an external curatorial advisor, and more that of a source of inspiration for considering the themes of *Les Immatériaux* in a broad perspective, aiming less for pragmatic propositions, but rather for adventurous speculations – like when, in the meeting on 24 April, Cassé asked: "how does one address the sky?"<sup>33</sup> In the interview done for the documentary film about *Les Immatériaux* in June 1985, Cassé speaks about the relation between matter, energy and light in a narrative that he may very well also have told a year earlier. Cassé said that the stars shine because they decompose, because they are destroyed, consumed.<sup>34</sup> This understanding of light, not as a primarily visual phenomenon, but as a transformative and material process, may well have influenced Lyotard's thinking – not least about the visual arts sites, especially *Peinture luminescente* and *Lumière dérobée*, which he was discussing with Bernard Blistène and in which light played such a prominent role. We can only speculate about this, but it seems that Cassé's influence on *Les Immatériaux* extended far beyond the site of *Creusets stellaires* and lay, more than anything, in his ability to articulate the cosmic dimension of the "immaterials".

### Mario Borillo

The traces that the three other scientific advisors – Mario Borillo, Pierre Rosenstiehl, and Jean-Pierre Raynaud – left in the *Immatériaux* exhibition, are less obvious than those of Caro and Cassé.

Mario Borillo, a computer scientist strongly interested in cognitive sciences and in the relation between informatics and the humanities, appears to have made a proposal for only one site in which a dialogue between visitors and a computer would have been enabled on one screen, while simultaneously a second screen would have visualized the data processing and calculations made by the computer to produce the answers.<sup>35</sup> The minutes of the various meetings record that on several occasions Borillo raised the question in how far certain exhibits might be understandable for the general audience. This audience-centered approach may have motivated the proposal for an exhibit that would have augmented the encounter with an "intelligent" computer system by an interface, on the second screen, that would have given an insight into the mathematical and computational basis of the human–computer dialogue.

Borillo made this proposal in April, and reported during the meeting in May that there were still uncertainties about the feasibility of the project.<sup>36</sup> It seems that the project was eventually abandoned, and for the realized exhibits that are thematically related – especially *Pré-parlé*

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<sup>32</sup> See Sabine Vigoureux's handwritten notes of a meeting with Cassé and the curatorial team on 19 April 1984 (1994033W232\_002\_b), and Cassé's intermediate report about the progress on his projects on 14 May (1994033W666\_013, p. 2).

<sup>33</sup> Handwritten notes Vigoureux, 1994033W232\_002\_c.

<sup>34</sup> Film *Octave*, ca. min 26:50.

<sup>35</sup> See 1994033W666\_012, p. 2. ("... un jeu informatique où le visiteur poserait à un ordinateur des questions personnelles. Sur un premier écran il obtiendrait la réponse pendant qu'il visualiserait sur un second [écran] les calculs faits par la machine pour lui répondre. [...] D'énigme en énigme, le visiteur, comme face à face avec le sphynx, pénétrerait dans les capacités et fonctions du langage, la logique du raisonnement, et les principes de la dialectique.")

<sup>36</sup> See 1994033W666\_013, p. 2–3.

and *Logiques artificielles* – there is no indication that Borillo had a role in their preparation. It is therefore hard to tell, in retrospect, whether and how Borillo's participation had much of an impact.

The other project of *Les Immatériaux* that most of the scientific advisors participated in, was the collaborative writing project, *Epreuves d'écriture*, that served to produce the content for the eponymous conceptual volume of the exhibition catalogue. Only Raynaud's name was missing from its list of contributors. Borillo, like most of the twenty-six authors, mainly contributed a series of short texts, commentaries on about twenty of the fifty keywords that were selected to structure the online conversation.<sup>37</sup> However, towards the end of the project, in December 1984, Borillo submitted three texts which were published in the annex of the catalogue, including a short reflexion about the essence of science (under the combined keywords of *désir / souffle*), one about the emergent role of informatics (*dématérialisation / matériau*), and an unusually long contribution about how writing was changed by the use of computers (*écriture / langage*).<sup>38</sup> This latter text, entitled "Some too pre-emptory and surely utopian hypotheses on the role of computer science in textual creation," forms a structured response to some of the questions that *Les Immatériaux* raised, and that were discussed throughout *Epreuves d'écriture*, including the question of authorship, of hypertextuality, and of artificial intelligence. This late submission can be seen as an attempt to compensate for the more dispersed contributions that Borillo had made in the advisory committee – a compensation that had only limited impact, given the meagre reception of this difficult catalogue volume.

### **Pierre Rosenstiehl**

It is even harder to grasp the impact that the mathematician Pierre Rosenstiehl may have had on the overall project. Rosenstiehl participated least frequently in the meetings, and he appears to have made only one proposal for a site – which eventually remained undeveloped.

On the face of it this seems surprising, because Rosenstiehl had a well-documented inclination to the arts and to philosophy. His specialisation in mathematics was in graph theory, on which he worked at the Centre d'Analyse et de Mathématique Sociales, CAMS, of EHESS, the École des hautes études en sciences sociales. Rosenstiehl was actively engaged in building bridges between the sciences and the humanities. He had, for instance, participated in two of the last seminars organised by the philosopher and semiotician Roland Barthes, one of which took place in 1979 in connection to the major exhibition project coordinated by the Centre de Création Industrielle at the Centre Pompidou, *Cartes et figures de la terre* (1980).<sup>39</sup> And Rosenstiehl's contribution to Barthes' final seminar, "The 'Dodécadédale', or in Praise of

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<sup>37</sup> Borillo's entries were all logged on 5 October 1984, suggesting that he did not return for the following online discussion. For a detailed analysis of *Epreuves d'écriture*, see Working Paper 7, and here, chapter xxx.

<sup>38</sup> See M. Borillo, *Quelques hypothèses trop préemptoires sûrement utopiques sur l'informatique dans la création textuelle*, in *Epreuves d'écriture*, Paris 1985, 238–242.

<sup>39</sup> See Pierre Rosenstiehl, « Les mots du labyrinthe », *Cartes et figures de la terre*, conférence du 24 février 1979 au séminaire de Roland Barthes, Collège de France, Centre culturel G. Pompidou, 1980, p. 94-103. See also Vanessa J. Compton: "The Labyrinthology of Pierre Rosenstiehl." In: *Understanding the Labyrinth as transformative site, symbol, technology: An arts-based inquiry*. Unpublished doctoral dissertation, Appendix 8.

Collections Canada, 2007. – In 1992, Pierre Rosenstiehl became a member of experimental literary collective Oulipo.

Heuristics", appeared in the prestigious US American art and theory journal, *October*, in 1983.<sup>40</sup>

Despite these obvious transdisciplinary affinities, Rosenstiehl's participation in the preparations for *Les Immatériaux* was less fruitful. In one of the first meetings with the scientific advisors, in February 1984, Rosenstiehl proposed a site about the relations of language, rules, and code, illustrated by the example of masks (*masques*) which are used in the production of integrated circuits.<sup>41</sup> This suggestion resonated with the theme of the "matrix" (*matrice*) that Caro and Lyotard discussed on several occasions, and the proposal was taken seriously enough to include it in the long list of sites assembled in April 1984, under the title of "Genealogy of the Integrated Circuit" (*généalogie du circuit intégré*). However, by the month of May nobody appeared to have followed up on the idea. Rosenstiehl indicated that he was planning a meeting in June with somebody who might help him to work out a plan, but after the summer the project just disappeared from the documents.<sup>42</sup> There are no further meetings with Rosenstiehl recorded in the *Chronology*.

We can only speculate about the reasons for this course of events. In the second half of the year 1984, Rosenstiehl was one of those participants in the *Epreuves* writing project who made only minimal contributions, in his case submitting fifteen short texts that were all logged on the same day in the first weeks of the process.<sup>43</sup> And Rosenstiehl stands out as the only one of the five scientific advisors who did not contribute to the volume of essays, *Modernes, et après ? Les Immatériaux* (1985), edited by Elie Théofilakis on the occasion of the exhibition, as a special issue of the *Editions Autrement*. The selection of thirty texts in this book represented the range of scientific and societal debates that *Les Immatériaux* sought to relate to. Given the participation of the other four scientific advisors – one of them, Jean-Pierre Raynaud, represented only in the form of an essay by a journalist about Raynaud's scientific theories – the absence of Rosenstiehl in this volume appears symptomatic of the distance that he took from the overall *Immatériaux* project.

### Jean-Pierre Raynaud

In contrast, the micro-biologist Jean-Pierre Raynaud probably joined the first meeting of the advisory committee in December 1983 better prepared than any of his colleagues. He had already been consulted by Thierry Chaput and his team, as an expert of "living materials," in

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<sup>40</sup> See P. Rosenstiehl: "The "Dodécadédale", or in Praise of Heuristics", *October*, Vol. 26 (Autumn, 1983), p. 17-26. Originally published in French as "Le Dodécadédale ou l'éloge de l'heuristique." *Critique* (août-septembre 1982), Paris, 785 – 796.

<sup>41</sup> See 1994033W666\_002, p. 4. (*M. Rosenstiehl presente [...] un site sur les masques dans les chaînes de fabrication des circuits intégrés. Pour lui, il n'est pas question de faire comprendre au visiteur les réseaux de Petri, opérations logiques, etc..., mais de le sensibiliser au problème du langage, règle du jeu, du code à travers les masques.*)

<sup>42</sup> See 1994033W666\_013, p. 3. In the same meeting on 14.5.1984, Rosenstiehl also made an informal proposal for a site on the "dematerialisation of war" (*dématérialisation de la guerre*, 1994033W666\_013, p. 4).

<sup>43</sup> There is an entry in Rosenstiehl's bibliography for his contribution to *Epreuves*: « Désir, écriture, geste, méandre, monnaie, preuve, réseau », *Epreuves d'écriture* pour l'exposition *Les Immatériaux*, Paris, éditions du Centre Georges Pompidou, 1985. The title does not mention Rosenstiehl's other entries for the keywords *auteur*, *code*, *dématérialisation*, *habiter*, *image*, *matériel*, *mémoire*, *ordre*; moreover, the entry for *désir* is only a placeholder referencing the entry on *monnaie*, which suggests that the bibliographic entry was made for rather symbolic reasons.

the spring of 1983, and again in November, while Lyotard was still in the United States.<sup>44</sup> His technological comparison of genetics and semiotics struck a cord with the curators:

Mr. Jean-Pierre Raynaud develops the analogy of genetics with codes, signs of language: programmable, artificial genes, manufacturing of cells, biological computer. It is not the sixth generation [of computers] but a change in the nature of the computer (storage of knowledge in a density of presence).<sup>45</sup>

In the mid-1980s, Jean-Pierre Raynaud worked for the French pharmaceuticals company Roussel UCLAF, where he did research in the field of Andrology and Clinical Chemistry, about the mechanisms of hormone action, and drug discovery of steroid hormones and anti-hormones. He thus brought in-depth knowledge about recent developments in genetics to the scientific committee.

Unfortunately the archival records of his contributions are incomplete. There are indications of two individual meetings with Raynaud, besides the committee meetings, during which practical matters of sites related to his topics would have been discussed.<sup>46</sup> The scattered documents provide a filiation of themes and preliminary titles which can retrospectively be ascribed to Raynaud, but which in the exhibition diffused into the anonymous layers of a collaborative effort.

The April 1984 overview document includes six projected sites which are otherwise undocumented and which were related to Raynaud's field of expertise:

excited fields [*champs excités*]  
 milky metamorphoses [*métamorphoses lactées*]  
 cancer probe [*sonde cancéreuse*]  
 living computer [*ordinateur vivant*]  
 fixed food [*aliment fixé*]  
 bio-food engineering [*genie bio-alimentaire*].

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<sup>44</sup> In the chronology, there is an entry for a meeting with Raynaud on 2.5.1983, 10:00 "les matériaux vivants"; and another one on 17.11.1983, 9:00 "TC, MM, Jean Pierre Raynaud" (both in the calendar of M. Moinot). – Jean-Pierre Raynaud the micro-biologist, who later joined the Sorbonne, Pierre and Marie Curie University, Paris 6, should not be confused with the contemporary artist of the same name, born 1939.

<sup>45</sup> Meeting minutes, 19.12.1983, 1994033W666\_001, p.3 (*M. Jean-Pierre Raynaud développe l'analogie de la génétique avec les codes, signes du langage : gènes programmables, artificiels, fabrication de cellules, ordinateur biologique. Ce n'est pas la sixième génération mais un changement de nature de l'ordinateur (stock de connaissances dans une densité de présence).*)

<sup>46</sup> The minutes of the meeting on 20.3.84 indicate that there was a meeting with Raynaud on 5.3.84, where he made a series of proposals, and on 10.5. (1994033W666\_009, p. 2). The *Chronology* also records meetings with Raynaud and Elie Théofilakis on 5.12. and 6.12.1984, presumably for the volume *Modernes, et après ?* (1985), which Théofilakis was editing at the time.

A related set of topics is listed under Raynaud's name in Vigoureux's handwritten notes, made a month later, during the meeting in May 1984:

*Bio temps (Gautray)*  
*lait (Houdebine)*  
*fusion cellulaire (Cazenave)*  
*code . lecture . écriture bio-ordinateur*  
*machine à composer la vie*  
*qui se transformeront bientôt en ordinateur*  
*reduction du temps*<sup>47</sup>

It is noticeable that in this latter list, reference is made to three scientists who Raynaud must have recommended in March, and who were consulted by members of Chaput's team. In the *Chronology* we find references to meetings with Louis-Marie Houdebine, biologist of development and reproduction, on 26 March; with Pierre-André Cazenave of the Institut Pasteur on 27 March, and with Jean-Pierre Gautray 30 March, encounters that, according to these records, were followed up only in Gautray's case by meetings on 20 July, and 9 August.<sup>48</sup>

It is not clear whether these meetings were in any way fruitful. Another name that crops up in relation to the topic of food is that of the food scientist Joseph Hossenlopp. Whether however he had any influence on the realisation of the food-related parts of the exhibition, especially *Ration alimentaire*, *Précuisiné-préparlé*, and *Arôme simulée*, is unclear.<sup>49</sup>

What we can say, though, is that the curatorial team continued to struggle with some of the sites related to the broader field of micro-biology and genetics – *Corps éclaté*, *Langue vivante*, and *Les trois mères* – well into the autumn and winter of 1984. In some of these sites associated with Raynaud (e.g. *Ration alimentaire*, *Précuisiné*) the theme was eventually elaborated only quite weakly – gesturing towards a topic, rather than offering a sharp or even controversial interpretation. Others (e.g. *Corps éclaté*, *Langue vivante*) ended up being rather illustrative, their aesthetic impact resting more on the medical and scientific imagery than on the concept of the presentation. In comparison, the complexity and differentiation in the concepts of the site proposed by Caro and Cassé is quite striking. We don't know the reasons for the difference, but what we can diagnose are two distinct types of approaches, namely the 'authorial' approach taken by Caro who suggested and then refined specific concepts for exhibition sites, in contrast to the more 'stimulating' approach taken by Raynaud who pointed

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<sup>47</sup> 1994033W232\_002\_f, p. 3.

<sup>48</sup> In Moinot's calendar, there is also reference to a panel discussion, "*table ronde: Houdebine, Cazenave, Gautray*", for 25.04.1984, of which it is not clear whether this was an event elsewhere in Paris, or arranged specially at the Centre Pompidou.

<sup>49</sup> In 1995052W027\_057, the site *Pré-cuisiné* is ascribed to Hossenlopp. On an anonymously made sketch specifying a proposal for grouping the sites in audio zones (1994033W234\_v2), presumably prepared by a team member in August or September 1984, the only site for which Raynaud is mentioned as the author or conceptor, is "Biokit (ordinateur vivant)", a project that was soon afterwards abandoned. The same sketch ascribes the projected site *O.C.N.I. ou objet consommable non-identifié* – another unrealised project – to Joseph Hossenlopp.

the curatorial team in the direction of other experts, leading to a proliferation of contacts and ideas that, as it were, proved hard to turn into concrete proposals for sites.

It may well be that, unlike Caro, Raynaud didn't see himself in the role of a co-curator, and there is no reason why a gifted micro-biologist should also be a dedicated exhibition curator. From the perspective of the exhibition visitor, though, and also in view of the relevance that these topics had in the conception put forward by Lyotard and Chaput, it was unfortunate that the important themes of genetics and life, the DNA as code, or human reproduction and its rapport with the question of authorship, were represented rather abstractly in the sites *Les trois mères*, which in the April 1984 concept still ran under Raynaud's working title "*génie génétique (ou hormonal)*", and *Langue vivante* which even in September drafts was still termed "*idiome du corps (ADN)*". The exhibits chosen for this latter site were finally two films by the biologist Jean-Pierre Ozil who was not solicited by Raynaud, but by one of the project managers at the CCI, Martine Moinot, who happened to be a personal friend of Ozil's and suggested the films documenting his research on animal cloning for presentation in the exhibition.

### Michel Tibon-Cornillot

Somebody who in the second half of the year 1984 was consulted instead of Raynaud, was the philosopher Michel Tibon-Cornillot (1936–2020). He was also the only person who, without having been part of the meetings of the scientific advisory committee, was mentioned as a sixth scientific advisors on credits page of the catalogue.<sup>50</sup>

Tibon-Cornillot was a philosopher with a strong interest in mathematics, and chaos theory. While working at EHESS, the *École des hautes études en sciences sociales*, in 1979, Tibon-Cornillot started a four-year research period at the Institut Pasteur for biological and medical research, convinced that the developments in the life sciences were having a major, yet widely unacknowledged impact on philosophy. In 1983/1984, on invitation by Jacques Derrida, he presented his ideas at the newly founded Collège International de Philosophie, in a seminar dedicated to the question of translatability between DNA and language. Tibon-Cornillot claimed an analogous materiality of both codes, while other philosophers insisted on their ontological difference.

The question also occupied Jean-François Lyotard and it seems consequential that Lyotard, together with other members of the *Immatériaux* team, met with Tibon-Cornillot around ten times, starting on 10 July 1984, and multiple other occasions in September and October. The topics of the meetings appear to have been not only conceptual, but also geared at developing concrete ideas for exhibition sites. For a meeting on 17 September, Lyotard notes in his calendar the titles of sites originally suggested by Raynaud, "*Corps éclaté, Biokit, Langue vivante ?*", and the name of Tibon-Cornillot is also mentioned in the handwritten notes of the scenographer Philippe Délis taken at the beginning of September in relation to the site *Langue vivante*.<sup>51</sup>

We already know that, from a curatorial perspective, the outcome of those meetings was meagre, and solutions for the exhibits in those sites had to be found elsewhere, even though Tibon-Cornillot's ideas supported the general approach of the curators. In one of his contributions to the *Epreuves d'écriture* writing project, he asked rhetorically:

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<sup>50</sup> *Edé*, p. 3.

<sup>51</sup> See 1995052W027\_021.

Doesn't the artificial, taking over the living and succeeding in doing so, manifest its deep origin, its kinship or its continuity with the living? Has the artificial ever been artificial?<sup>52</sup>

Tibon-Cornillot's theoretical positions were both challenging and crucial for the questions that Lyotard and Chaput sought to raise in the sites related to the materiality and the makeability of life:

"The apparent chaos that more and more realizations of molecular genetics allows – hybrids, transgenics, and so on – is linked to a cosmic dimension that is not only on the order of discursive representations or those of art (Hieronymus Bosch) but passes through concrete realizations."<sup>53</sup>

In a text that appeared in English under the title of "Genetics and the Inhuman in Man" in 1985 and that was presumably written in 1984, Tibon-Cornillot urges his colleagues to overcome the type of anthropomorphism of which he would have, no doubt, also accused Lyotard:

"... at the moment in which his stubborn anthropomorphism wavers and everywhere arises the 'ahuman' that he has discovered and installed within himself, a question comes up with // regard to man: What does the irruption of the first attempts made by a species on genetic patrimonies that were formerly submitted to other laws mean to the biosphere? What this initiates seems more interesting than the partial findings we have so much difficulty in facing."<sup>54</sup>

We can imagine how Lyotard was both fascinated and irritated by these ideas which he himself was struggling with, as documented in the series of talks from 1985 and 1986 which were published in 1988 under the moniker that Tibon-Cornillot had also used, *L'Inhumain*. A figure of thought that Lyotard develops on several occasions, like in the lecture "Matter and Time" of April 1985, is that, in a typical double movement, the modernist drive towards transparency and control brings about the very technoscientific condition which imply the

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<sup>52</sup> *Edé*, p. 12 (TIBO. 176, 10 OCT.) (*L'artificiel, reprenant le vivant et y réussissant, ne manifeste-t-il pas son origine profonde, sa parenté ou sa continuité avec le vivant. L'artificiel, a-t-il jamais été artificiel ?*) See also Tibon-Cornillot's commentary on the notion of maternity, which appears to point toward the tabulation of various types of human reproduction in the site *Les trois mères* (*Edé*, p. 128, TIBO. 180, 10 OCT.), marking possibly the most immediate connection between Tibon-Cornillot's discourse and the exhibition.

<sup>53</sup> Michel Tibon-Cornillot: "Genetics and the Inhuman in Man." In *Diogenes*, Vol. 33, No. 131, 1985, p. 85–100, qu. p. 97.

<sup>54</sup> *Ibid.*, 99–100. Some of the sections in this text appear verbatim (in French) in Tibon-Cornillot's submission for the annex of *Epreuves d'écriture*, on the keyword of "Nature" (TIBO., 15 DEC., p. 249–253). For the ideological context in which Tibon-Cornillot framed these debates around the same time, though less explicitly in his contributions to *Les Immatériaux*, see also Michel Tibon-Cornillot: "Génétique et totalitarisme." In: Jean-Louis Weissberg (ed.): *1984 et les présents de l'univers informationnel*. Paris, CCI, Centre Georges Pompidou, 1985.

inescapable deposition of the ideal of the modern human subject. In October 1984, Tibon-Cornillot had put it like this:

"The transparency built on an absolute anthropocentrism comes up against such an astonishing success (the genetic code is an example) that little by little another type of intuition arises. At the very moment when men think they succeed in their effort to dematerialize matter, the instruments of this process, languages, codes, take root in matter, in the living, and are "materialized" to a degree never reached before. Perhaps it is not the world, the living, the things, which are transparent to his conceptual control but man who is transparent to the world."<sup>55</sup>

Given the intensity of their dialogue it is surprising to find that, in retrospect, Tibon-Cornillot remembered the encounter with Lyotard as conflictual and mutually dissatisfactory.<sup>56</sup> Tibon-Cornillot had been invited by Lyotard, but – according to his recollections 30 years later – Lyotard was irritated by his opinions and wanted to speak about the issue of translatability and manipulability of genetic code, and thus of life, only metaphorically, not scientifically. We can only speculate about the reason for this rather negative image in which Tibon-Cornillot remembered their discussions. It stands in a rather stark contrast to the fact that there was such a high frequency of meetings in the autumn of 1984 – of which Tibon-Cornillot also only remembered "one or two" –, and to Lyotard's intellectual engagement with Tibon-Cornillot's propositions. In the end, Tibon-Cornillot was one of the handful of people interviewed for the documentary film, *Octave aux pays des immatériaux* (1985), suggesting that his theoretical position was seen as one of the cornerstones of the *Immatériaux* project.

### Traces of the science thread: Lyotard, Caro

The work with the scientific advisors was an important element in the conceptual foundation of *Les Immatériaux* in general, as well as forming the context from which the proposals for thirteen exhibition sites were sourced. As indicated by Lyotard in the interview with Blistène quoted earlier, the meetings of the scientific committee were also a way for him to learn about current debates in the sciences about which, in *La Condition postmoderne*, he had written rather superficially. But more than just a knowledge update, Lyotard indicates that the *Immatériaux* project as a whole was a transformative experience. In one of the interviews conducted during the opening days, Lyotard conspicuously blurs the work on the exhibition, and the diagnosis of a crisis of modernity. The necessity of change afforded by this crisis, he suggests, is not only something that was to be conveyed to the exhibition audience, but also something that was happening to him:

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<sup>55</sup> *Edé*, p. 130–131 (TIBO. 181, 10 OCT.) (*La transparence bâtie sur un anthropocentrisme absolu se heurte à une si étonnante réussite (le code génétique en est un exemple) que peu à peu se lève un autre type d'intuition. Au moment même où les hommes pensent réussir leur effort de dématérialisation de la matière, les instruments de ce procès, langages, codes s'enracinent dans la matière, le vivant, et se "matérialisent" à un degré jamais atteint. Peut-être n'est-ce pas le monde, le vivant, les choses, qui sont transparents à sa maîtrise conceptuelle mais l'homme qui est transparent au monde.*)

<sup>56</sup> Personal conversation of the author with Michel Tibon-Cornillot, Paris, 22 September 2016. – In this meeting Tibon-Cornillot also related his impression that Lyotard "did not have the exhibition under control" (*pas de contrôle*), which is probably true, and Lyotard would have been the first to admit it.

"We have all been marked by this enterprise, this completely excessive adventure. [...] I was very moved by this work. *The Postmodern Condition* was not dramatized enough, had too simple answers. [...] Post-modern [...] designates a change, but not a period."<sup>57</sup>

In Lyotard's writings from the period during and immediately after *Les Immatériaux*, especially *The Postmodern Explained* and *The Inhuman* (1988), there are occasional references to the sciences, in which the exchanges with the scientific advisors seem to resonate. Thus, a remark like "matter is energy and mind is contained vibration", made in *The Inhuman* with respect to the way in which both microphysics and astrophysics change the conception of matter, echoes notions proposed by Cassé and Raynaud; and Lyotard's comment on the relation of life, technics and code, made with regard to the living cell, comes across as a response to Tibon-Cornillot's theoretical considerations.<sup>58</sup> It seems likely that Lyotard was thinking of 'modernist' scientists like Caro and Raynaud when, in the introduction to *The Inhuman*, he referred to the discourse "maintained about their researches by the scientists, the technologists and their accredited philosophers to legitimate, scientifically and technologically, the possibility of their development. Inevitably, it is a discourse of general physics, with its dynamics, its economics, its cybernetics."<sup>59</sup>

In this context Lyotard also returned to an image that Cassé had called up in his contributions, and that seems to have haunted Lyotard, namely that of the finality of the sun and the solar system, and with it the finality of human thought, which became for him the ultimate challenge to modernity and its metaphysics of development and progress. This metaphysics, Lyotard writes in the introduction to *The Inhuman*, "has no end, but it does have a limit, the expectation of the life of the sun. The anticipated explosion of this star is the only challenge objectively posed to development."<sup>60</sup>

In a text first published in July 1984 and republished in *The Postmodern Explained*, Lyotard makes direct reference to Cassé when he speaks about the uniqueness and unrepeatability of the first second of the Big Bang, "if I have understood Michel Cassé correctly."<sup>61</sup> And the narrative he offers elsewhere in the same book to explain the dramatic change which postmodern thinking has to accommodate, is an adaptation of the story that Cassé told, for instance, in the script for *Creusets stellaires*. Lyotard writes:

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<sup>57</sup> Interview with Jean-François Lyotard, conducted by François Dumont, *Le Matin de Paris*, 28 March 1985, p. 23–24. (*Nous avons tous été marqué par cette entreprise, cette aventure tout à fait démesurée. [...] Moi, j'ai été très déplacé par ce travail. La Condition postmoderne n'était pas assez dramatisé, avait des issues trop simples. [...] Post-moderne [...] désigne un changement, mais pas une période.*) See also Jean-Louis Boissier: "La question des nouveaux médias numériques", in: Bernadette Dufrene (ed.): *Centre Pompidou: Trente ans d'histoire*. Paris: Éditions du Centre Pompidou, 2007, p. 374–391, esp. p. 380.

<sup>58</sup> See Lyotard, *The Inhuman*, 1988/1991, p. 45 (on energy, in a lecture held in April 1985), p. 52 (on the living cell, lecture October 1986)

<sup>59</sup> Lyotard, *The Inhuman*, 1988/1991, p. 5.

<sup>60</sup> Lyotard, *The Inhuman*, 1988/1991, p. 7.

<sup>61</sup> Lyotard, *The Postmodern Explained*, xxx (*Postmoderne für Kinder*, 85), "Dépêche à propos de la confusion des raisons," first publ. in French in *Le Monde*, 1–2 July 1984. See also Lyotard's remark that "contemporary astrophysics likes to tell the story of the universe since the Big Bang", in "2. *Apostille aux récits*", dated London, 6 February 1984; Kiff Bamford has pointed out that this text was probably not published previously, and that in the manuscript there is an indication to "Geoff Bennington 23/12/83" (Bibliothèque littéraire Jacques Doucet, JFL 43-1). This would have been four days after the first meeting with the scientific advisors.

The cosmos is the result of an explosion; the debris is still spreading under the influence of the initial impact; the burning celestial bodies transform the elements; their days are numbered; those of the sun likewise; [...].<sup>62</sup>

While the 'transformation of the elements by the exploding and burning stars' and the malleability of matter in the cosmic laboratory had been an important theme for *Les Immatériaux*, the other, the philosophical lesson from this story was further elaborated by Lyotard in the text *A Postmodern Fable*, seven years later. It contains a speculative astrophysical, biological and transhumanist narrative about the evolution of the sun and the earth, about their future demise, and about the possibility of an "exodus" of humans (or rather their brains); a story that he qualifies as "postmodern", and whose astrophysical part again repeats Cassé's casually apocalyptic narrative.<sup>63</sup>

The scientific framework of this fable that Lyotard sketches is that of *Les Immatériaux*. In 1992 he interprets it as having a transhumanist agenda that would enable, in the long term, a departure from the doomed planet:

"At the time of the telling of the story, all the research currently in progress—logic, econometrics and monetary theory, computing, physics of conductivity, astrophysics and astronautics, biology and medicine, genetics and dietetics, catastrophe theory, chaos theory, strategies and ballistics, sports techniques, system theory, linguistics and experimental literature—all this research was devoted, *de facto*, either closely or remotely, to testing and remodeling the so-called human body, or to replacing it, in such a way that the brain be able to function with the aid of the only energy resources available in the cosmos. In this way, the final exodus far away from the negentropic system of the Earth was being prepared."<sup>64</sup>

The more general insight that Lyotard drew from the encounter with contemporary scientists – and not least with the engaging storyteller Michel Cassé – was the degree to which modernity relied on such narratives:

"Realism accepts and even demands the presence of the imaginary within it, and that the latter, far from being foreign to reality, be a state of it, the nascent state. Science and technique themselves tell fables to no less an extent, are no less poetic than painting, literature or cinema. The only difference between them

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<sup>62</sup> Lyotard, *The Postmodern Explained*, xxx (Postmoderne für Kinder, 110) "Billet pour un nouveau décor." According to Bamford, the manuscripts are dated 1 April 1985 (Bibl. Doucet, JFL 43-1) and 12 April 1985 (Bibl. Doucet, JFL 43-2).

<sup>63</sup> Lyotard, "A Postmodern Fable," *Yale Journal of Criticism*, 6:1, 1993 (first publ. in German, in 1992), French publication, "Une fable postmoderne," in *Moralités postmodernes* (1993), p. 79–94.

<sup>64</sup> Lyotard, "A Postmodern Fable," 1993, p. 241.

resides in the constraint of verification/ falsification of the hypothesis. The fable is a hypothesis which is exempted from this constraint."<sup>65</sup>

In contrast to the resonances that the work with the scientific committee had in Lyotard's own later writings, the respective impact that this collaboration may have had on the scientists remains opaque. Seeing though how Raynaud departed from the scene early, and knowing that Borillo and Rosenstiehl were rather disenchanted, it seems unlikely that their feedback would have been positive. Cassé saw the production of the site *Creusets stellaires* to the end, and he participated both as a slightly more active co-author of the *Epreuves d'écriture* project and as an expert interviewed in the *Octave...* documentary, but in both cases his contributions appear more driven by the wish to communicate his ideas than by a particular interest in the *Immatériaux* project.<sup>66</sup>

Among the five advisors, it is again Paul Caro who forms the exception. In two reports that he wrote about the popularization of science in the 1990s, he mentioned *Les Immatériaux* and thus actively contributed to the legacy of the exhibition.

The first of these reports is a text, published in 1990, about the challenges of the popularisation of scientific knowledge, in which Caro describes the various forms of knowledge production and distribution, and discusses the problems and possibilities of conveying them to wider audiences.<sup>67</sup> Lyotard is one of only a very small number of contemporary authors mentioned by Caro, and the only contemporary philosopher.<sup>68</sup>

Caro speaks about different media of science communication, incl. academic journals, reports, and popular journals, and also about museums and exhibitions. He does not do this systematically, but emphasises the importance in the popularisation of scientific knowledge.<sup>69</sup> *Les Immatériaux* is the only exhibition mentioned by its title, whereas otherwise Caro speaks about museums and exhibitions in mere general terms.

In an passage where Caro deals with the challenges for scientists to engage in the popularisation of their specialized knowledge, and the dangers of simplification, he refers to *Les Immatériaux* as an exceptional example:

It should be noted here that while the mediator is perfectly identified when he signs an article, a book or a film, this is not the case for an exhibition, because of its character as a collective work, for if a mediator proposes a scenario, he knows that it will be transformed by the chain of material realization, and sometimes made unrecognizable. The only way to avoid this is to give the mediator absolute

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<sup>65</sup> Lyotard, "A Postmodern Fable," 1993, p. 244.

<sup>66</sup> Michel Cassé, in a rather 'off the cuff' remark made in 2021, said, "I learned nothing from *Les Immatériaux*." (Personal telephone conversation with the author, 5.11.2021.)

<sup>67</sup> Caro, Paul: *La vulgarisation scientifique est-elle possible?* Nancy: Presses Univ. de Nancy, 1990.

<sup>68</sup> Caro, *La vulgarisation scientifique*, 1990, p. 25. Lyotard is mentioned with respect to the postmodern discreditation of the grand narratives of liberation and emancipation.

<sup>69</sup> In this context, Caro mentions the classical model of communication theory (R. Jakobson) which Lyotard frequently used and which Caro here quotes from the *Album* part of the *Immatériaux* catalogue (Caro 1990, p. 30; quotation from the "Présentation" of April 1984, reprinted in *Album*, 1985, p. 17); it is remarkable that Caro should use this obscure source (a preliminary concept for an exhibition), rather than employ a more standard bibliographic source.

authority to intervene and correct, if necessary, at all levels. But such a procedure is unusual (it was however the case for Jean-François Lyotard on the occasion of the *Immatériaux* at Beaubourg in 1985).<sup>70</sup>

Beyond the fact that his passage draws attention to the exceptionality of *Les Immatériaux*, it is remarkable for two reasons. Firstly, because it describes Lyotard's role as having "absolute authority to intervene and correct, if necessary, at all levels," a characterization that contradicts the notion that this was a collaborative project with multiple, networked decision-makers. And then it is remarkable that, in the first sentence, Caro affirms that somebody in his own role as scientific advisor cannot expect to be recognized for every part of his or her contribution, given the collective nature of the work and the realization process during which an initial idea can be turned into quite something different in the final result.

Caro would have had good reasons to decry such a lack of recognition, even if he understood its systemic nature. He had written the initial concepts for seven of the exhibition sites without being mentioned as their author in the *Inventaire* catalogue.<sup>71</sup> And at least Caro himself would have noticed that on the *Inventaire* page for the site *Matricule* the introductory sentence, which was usually assumed to have been penned by Lyotard, was taken almost *verbatim* from Caro's concept for the site.<sup>72</sup>

But Caro saw that in a complex and collaborative process like this it was difficult to register individual authorship. In his own concepts, Caro occasionally referred to Lyotard's exposé for the exhibition, a fact that underscores his awareness of a dialogical process in which the "origin" of a certain idea was hard to pin down. After all, Caro's suggestion for what would become the site *Petits invisibles* was a response to a request that Lyotard had first put to Cassé. – The insight into collective authorship was a lesson that Caro had learned during the work on *Les Immatériaux*, and that in 1990 he relayed to his readers.

The same thematic terrain is covered again in a longer report that Caro co-authored with Jean-Louis Funck-Brentano, where the question of the production, communication and public perception of science is treated in a more extensive, historical and more explicitly international perspective.<sup>73</sup> Again, critical discussions of scientific language, and of the role

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<sup>70</sup> Caro 1990, p. 30 (*Il faut remarquer ici que si le médiateur est parfaitement identifié lorsqu'il signe un article, un livre ou un film, il n'en est pas de même pour une exposition, à cause de son caractère d'oeuvre collective, car si un médiateur propose un scénario, il sait qu'il sera transformé par la chaîne de la réalisation matérielle, et quelquefois rendu méconnaissable. Le seul moyen d'éviter cela, c'est de donner une autorité absolue au médiateur pour intervenir et corriger, si besoin est, à tous les échelons. Mais une telle procédure est inhabituelle [ce fut pourtant le cas pour Jean-François Lyotard à l'occasion des "Immatériaux" à Beaubourg en 1985].*) See also Caro's comments about the use of popular science and journalistic sources in the preparation of exhibitions – comments, though, which may have been made with projects other than *Les Immatériaux* in mind (ibid. p. 19–20).

<sup>71</sup> Caro shared this fate, amongst others, with the curator of contemporary art, Bernard Blistène, and the architecture curator, Alain Guiheux. Only Michel Cassé and Jean-Pierre Bibring were credited in the *Inventaire* for the concept of the site *Creusets stellaires*, maybe because the site included an audiovisual production understood as a separate item, and because Bibring, an external contributor, played an important role that had to be acknowledged and that led to the consequential necessity of also crediting Cassé, and Patrick Arnold and Annyck Graton for the technical realisation.

<sup>72</sup> See the last couple of sentences in Caro's document dated 20 March 1984, 1994033W666\_010, p. 4.

<sup>73</sup> Paul Caro, Jean-Louis Funck-Brentano: *L'appareil d'information sur la science et la technique*. Paris: Technique & Documentation, 1996. – Jakobson's communication model is here (p. 28) quoted from its proper source, Jakobson 1963 (see above, footnote 69\*\*\*).

of images, and technical media in science communication feature prominently.<sup>74</sup> The chapter on the role of museums and exhibitions mentions several science centres and exemplary exhibitions (esp. at the Cité des Sciences et de l'Industrie, La Villette, Paris). The only one instance where reference is made to *Les Immatériaux*, the authors talk about the design and presentation of content in exhibitions, which according to Caro and Funck-Brentano is often,

"very sophisticated, but not always easily readable on the ground. The exhibition architects have ideological principles and follow a plan. This is not always easy to understand. Especially when the designer has been inspired by the post-modern approach (following the great exhibition organized by Jean-François Lyotard at the Centre Pompidou in 1985 on the theme of "Immaterials"). The exhibition platforms are then presented with multiple entrances and the visitor is free to choose his path. The things are presented on a same mosaic and exploded plan (like the juxtaposition of districts of different cultures in the modern cities). The possible courses are then numerous, and the effort required of the visitor can be rather considerable insofar as he/she is not guided by a thematic of the kind "room I", "room II", "room III", etc."<sup>75</sup>

From the perspective of a history of exhibitions, this remark is noteworthy, firstly, because it posits *Les Immatériaux* as exemplary and as a turning point in the design and presentation of scientifically related contents in exhibitions, highlighting several of its key scenographic features. And secondly, it is remarkable that this description was given in a report subsequently adopted by the Académie des Sciences and its Comité des Applications de l'Académie des Sciences, CADAS, as their sixth joint report. – We can surmise that this description of the *Immatériaux*'s radical exhibition design helped to foster the reputation of the exhibition – at least among people concerned with science communication in France.

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<sup>74</sup> Caro/Funck-Brentano, 1996, p. 49–86. In comparison with the earlier report, the section on the media of science communication is much more elaborate and includes recent developments in digital media, the Internet, and databases.

<sup>75</sup> p. 91 (*En général, celle-ci est très étudiée, mais pas toujours facilement lisible sur le terrain. Les architectes d'expositions ont des principes idéologiques et suivent un plan. Celui-ci n'est pas toujours aisé à découvrir. En particulier lorsque le concepteur a été inspiré par l'approche post-moderne (à la suite de la grande exposition organisée par Jean-François Lyotard au Centre Pompidou en 1985 sur le thème des "Immatériaux"). Les plateaux d'exposition se présentent alors avec des entrées multiples et le visiteur est libre de son parcours. Les choses sont présentées sur un même plan mosaïque et éclaté (comme la juxtaposition de quartiers de cultures différentes dans les villes modernes). Les parcours possibles sont alors nombreux, et l'effort exigé du visiteur peut être assez considérable dans la mesure où il n'est pas guidé par un thématique du genre "salle I", "salle II", "salle III", etc.)*)