

choreography. The film shows a closeup of Villani presenting Cercignani's conjecture on a blackboard. In the previous room he had already established this perennial tool of the mathematical lecture room as a kind of right arm, an extension of himself he could use to communicate his ideas. (In fact, despite the growing use of computers by mathematicians—and not just the experimental mathematics community—this digital tool seems to remain here in the closet.) The film begins with a large shot of the blackboard, with Villani pacing back and forth in front of it. Then it zooms in as he raises his chalk and makes a few marks, as if warming up. Then he lets loose on a dazzling array of points, lines, curves, all in a rhythm of anticipation. He looked like a conductor goading his mathematical objects along. The viewer watches the performance but feels that the substantial practice and repetition involved in the dance of the chalk is somehow overshadowed by a sense of immediacy, persuasiveness, and seeming newness. I was reminded of Gilles Châtelet's (1993) assertion of the intimate link between gestures and diagrams in mathematics and, especially, the gesture as the locus of mathematical inventiveness. This small film seemed to be the most compelling example to me of mathematics and art and of mathematics as art.

In the last large room stood a comparatively lonely aluminum sculpture by Hiroshi Sugimoto of a surface of revolution of constant negative curvature. Apparently, the extreme tip—the gesture to a point at infinity—is so small that the artist required modern robotics to fashion it.

### On Art and Mathematics

There are many conferences, books, courses, and classroom activities that try, in various ways, to

explore or forge connections between mathematics and art. In many educational settings, art is used as a motivational context in which to attract the attention of learners so that they might compare some ratios (Alberti's perspective drawing) or calculate some areas (Mondrian's geometric abstraction), just to name some popular examples. One consequence of these well-meaning approaches is that they endorse the belief that mathematics itself is an aesthetically sterile domain or at least one whose potentialities are realised only through engagement with external domains of interest. The mathematicians videotaped by Depardon and Nougaret insist otherwise, and the situations shown in the second room provide at least some visual insight into the compelling patterns and structures that mathematicians work with. But I had hoped that this meeting of art with mathematics would have more provocatively, subtly, and perhaps even uncomfortably transformed the viewer's way of thinking of mathematics.

I wonder whether the framing of the exhibit—at least the top floor—in terms of Gromov's four mysteries started things off on the wrong foot. Art tends to be good when it evokes mysteries for the viewer or nudges the viewer toward mysteries otherwise overlooked, but when it earnestly points them out, the viewer is left with little more than a fact.

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## Sudden Disorientation in a Paris Museum

*Michael Harris*

At least one French journalist is convinced that the message of the exhibition that opened last October in Paris at the Fondation Cartier for Contemporary Art is that Alexander Grothendieck has now been "rehabilitated". Maybe she reached this conclusion because the exhibition, a collaborative effort involving (among others) nine artists, eight mathematicians, and a Large Hadron Collider—more on them later—is entitled *Mathématiques, un dépaysement soudain*, a quotation from Grothendieck's

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unclassifiable and (so far) unpublishable 900-page memoir *Récoltes et Semailles*. Who was the first to realize Grothendieck was in need of rehabilitation? It wasn't a mathematician: though those who knew him continue to regret his decision to abandon his position at the center of algebraic geometry in the early 1970s on political grounds, his influence has only grown in the intervening years, and he is now regularly listed as one of the greatest mathematicians of the twentieth century, occasionally as the greatest of all.<sup>1</sup>

That Grothendieck might need rehabilitation and that his time has now come sounds like an idea hatched by the French public relations industry, known in France as *communications* or just *com*, always alert to the question of what is appropriate to believe about any subject of importance—and

<sup>1</sup>For example, at this site: <http://blog.tanyakhovanova.com/?p=218>.

in France mathematics is such a subject. By turning his back on prestige, going so far as to refuse the Crafoord Prize in 1988, Grothendieck broke with acceptable public opinion, expressing ideas potentially subversive to the social order. But now he can be forgiven.

If Grothendieck's ideas are no longer dangerous, it's not only because his public statements over the last twenty years or so have become increasingly bizarre, culminating with his insistence in 2010 that all copies of his work be removed from libraries and destroyed. Ideas like Grothendieck's have in any case lost their relevance to opinion makers.<sup>2</sup> The evolution was symbolized by the election of French President Nicolas Sarkozy in 2007 on a platform of *argent décomplexé*, relaxed money. Sarkozy's supporters called upon the rich not to be ashamed of their wealth, and the president himself was notorious for his fascination with symbols of affluence: yachts, expensive restaurants, and especially the Rolex. Jacques Séguéla, *com* champion closely associated with the (opposition) French Socialist Party, was perplexed when the press kept writing about the Rolex: "Si à 50 ans, on n'a pas une Rolex, on a raté sa vie" [If you don't have a Rolex by the time you're 50, you've wasted your life].

Nowadays *dépayement* is a commodity French travel agents market to busy professionals looking for novel vacation experiences, the prepackaged unfamiliarity of an unfamiliar sun, an unfamiliar landscape, a (slightly) unfamiliar cuisine, comparable to the English "change of scene" rather than to *A Beautiful Elsewhere*, the Cartier exhibition's official English title. But the word literally refers to the state of not being in one's hometown, and its alternative meaning of "disorientation" is by far the better translation in reference to Grothendieck. Imagine Club Med offering a one-way ticket to the middle of a war zone in a foreign country where you are at constant risk of deportation and death. That profoundly disorienting experience, still on offer in many parts of the world, was Grothendieck's as a teenager during the Second World War. The experience one takes home from *A Beautiful Elsewhere* is not of comparable intensity.

The Fondation Cartier is the creation of Rolex's rival, the French jeweler and watchmaker Cartier. I'm no expert in the semiotics of luxury timekeeping and can't tell you where Rolex stands relative to Cartier—official purveyor in times past to such kings as Carlos I of Portugal, Peter I of Serbia, Fouad I of Egypt, and Zog I of Albania—on the scale of prestige vs. vulgarity. What I do know is that if I were Cartier, I would be jealous of the lineup Rolex has assembled, both for its gravitas (Hans Magnus Enzensberger! Toni Morrison!) and for its hipness (Brian Eno!! Kate Valk!!) in its annual Mentor and

<sup>2</sup>Or so it seemed when the exhibition was planned, before the surprising events of 2011.

Protegé Initiative. The luxury industry (Espace Cardin and LVMH in Paris, Fondazione Prada in Venice) is well represented among the branded art exhibition spaces that have proliferated in recent decades, alongside insurance (the Generali Foundation in Vienna), banking, shopping (Selfridge's), and *com* itself (the Saatchi Gallery in London).<sup>3</sup>

Damien Hirst, hardly the most high-minded of the Young British Artists, once said, "...I'm not Charles Saatchi's barrel-organ monkey....He only recognises art with his wallet...he believes he can affect art values with buying power, and he still believes he can do it."<sup>4</sup> Years before the Fondation Cartier moved into its Jean Nouvel-designed exhibition space on Boulevard Raspail—of which Eric Hazan wrote that it "at least has the merit of having preserved Chateaubriand's cedar tree"—Alain-Dominique Perrin, then, as now, president of the Fondation Cartier, wrote candidly about the goals of art sponsorship: "Patronage of the arts is not only a formidable public relations [i.e., *communications*] tool, it's much more than that; it's a tool to seduce public opinion." The strategic goal, wrote Perrin, is to "neutralize criticism."<sup>5</sup>

Echoing situationist Guy Debord but from the other side of the barricades, so to speak, Perrin added, "The efficacy of this PR strategy is not limited to creating the event...patronage is...a medium that makes use of the other media." Media coverage of *A Beautiful Elsewhere* has indeed been massive, including an entire special issue of the monthly popular science magazine *Sciences et Avenir* (with the Cartier logo on the front cover), an ad campaign that plastered every corner of the French capital with billboards, and of course a few brief articles in the daily and weekly press.

I ought to stress that I'm not opposed to private philanthropy or even corporate sponsorship per se. I have benefited from the former both personally and as an organizer of conferences, and in any case there's no way to work these days as a mathematician, much less as an artist, without coming to some arrangement with private funding sources. I ran across Perrin's remarks in a 1994 conversation between radical conceptual artist Hans Haacke and sociologist Pierre Bourdieu. Haacke's projects in the 1980s included a collage (*Cowboy with Cigarette*) in the style of Picasso as a reaction to Philip

<sup>3</sup>For banking: the Deutsche Bank collection in Frankfurt, New York, and around the world, and the Bank Austria Kunstforum in Vienna. To this list we might add the former collaboration between Philip Morris and the Whitney Museum of American Art in New York.

<sup>4</sup><http://www.guardian.co.uk/uk/2003/nov/27/arts.artsnews>. This year Saatchi himself observed (Guardian, 2 December 2011) that "being an art buyer these days is comprehensively and indisputably vulgar."

<sup>5</sup>Quoted in P. Bourdieu and H. Haacke, *Libre-échange*, Paris: Seuil (1994), pp. 26–27, 37.

Morris sponsorship of a 1989 exhibit on early cubism and an exploration, modeled on jewelers' window displays, of Cartier's links with apartheid South Africa. But Haacke himself has works in the Generali Foundation collection, and who can blame him? The IHES is no less brilliant a center of research since the creation a few years ago of the AXA Chair for Mathematics.<sup>6</sup> But any occupant of the chair has to know that, as far as the insurance company is concerned, he or she is now wearing the AXA jersey.<sup>7</sup>

No such branding accompanied the unveiling in October of a plaque at the École Normale Supérieure thanking the Fondation Jean-Luc Lagardère for the renovation of the Département des Mathématiques et Applications. There is no mention of the event on the Lagardère or EADS websites. Nor did the weekly magazine *M—Le Monde's* answer to the *New York Times' T*—refer to the ENS in its cover story, published in October, on “the dream life of [the late Jean-Luc's son] Arnaud Lagardère,” who “reigns over arms and media, aviation and publishing.” This is a bit strange, since ENS is in the center of Paris and is much better known than the IHES. Grothendieck may be indirectly responsible for this discretion. Although the Lagardère conglomerate is mainly active in publishing and media, it is “a major shareholder in EADS...the leading aeronautics, space and defence group in Europe and the second largest in the world...and exercises joint control over the company.”<sup>8</sup> Grothendieck, the “great thinker, unknown outside theoretical cliques,” is mentioned several times in the exhibition catalogue—astrophysicist Michel Cassé, one of the exhibition's three curators,<sup>9</sup> even dedicates his catalogue contribution to Grothendieck—but there's not a word to explain his absence from the community of researchers. His resignation in 1970 from the IHES is mentioned cryptically in the introduction to the special issue of *Sciences et Avenir* on the Cartier exhibition. You'll have to turn to the *Notices of the AMS* to learn that his departure was precipitated by his “conflict with the founder and director of the IHES...over military funding for the institute.”<sup>10</sup>

Visitors arriving at *A Beautiful Elsewhere* are first directed to the Library of Mysteries, fruit of

<sup>6</sup>A move that brings no material advantage to its holder but instead allows the IHES to use his or her salary to invite additional visitors.

<sup>7</sup>See [www.axa-research.org/sites/dev/files/u/video/axa\\_institutionnel\\_rework.flv](http://www.axa-research.org/sites/dev/files/u/video/axa_institutionnel_rework.flv).

<sup>8</sup>Information from [www.lagardere.com](http://www.lagardere.com).

<sup>9</sup>Along with IHES director Jean-Pierre Bourguignon and Hervé Chandes, director general of the Fondation Cartier.

<sup>10</sup>From Allyn Jackson's article *Comme Appelé du Néant—As If Summoned from the Void: The Life of Alexandre Grothendieck*, part 2, *Notices of the AMS*, November 2004, p. 1199.

a collaboration of filmmaker David Lynch and punk rock icon Patti Smith with geometer Misha Gromov. The laws of physics, life, the human brain, and mathematical structure are the mysteries in question. Perfectly innocent when Gromov listed them a few years ago in a popular book about mathematicians entitled *Les déchiffreurs*, in the hands of the Cartier exhibition's curators these mysteries acquire the metaphysical urgency of the “Mysteries of Isis” to which Tamino is promised after his successful passage through the “Temple of Tests” in Mozart's *Magic Flute*. And one must indeed walk through a colonnade in order to enter the library, on one of whose walls a selection of books, chosen by Gromov for the light they attempt to shed on the four mysteries, thunder down from the zenith against the background of a handheld impending storm in a recognizably Lynchian night.<sup>11</sup> David Foster Wallace wrote that

AN ACADEMIC DEFINITION of Lynchian might be that the term “refers to a particular kind of irony where the very macabre and the very mundane combine in such a way as to reveal the former's perpetual containment within the latter”.<sup>12</sup>

Irony being altogether absent at the Fondation Cartier and in the exhibition catalogue, it would be better to say that the books in the library are framed by a *parody* of the Lynchian night. Other images are occasionally projected on the wall: when a white sheep appears against a neutral background, Patti Smith's voice recites “Baa baa black sheep” (“Yes, Sir” is translated “Oui monsieur”). Later in the cycle, her face materializes, swaying on the library ceiling (“in the shape of a zero”), blurring and fading as she sings an excerpt from Swinburne's *Loch Torridon*:

All above us, the livelong night,  
Shadow, kindled with sense of light;  
All around us, the brief night long,  
Silence, laden with sense of song.

The next space is called the Room of the Four Mysteries and features one exhibit for each mystery on Gromov's list, plus a few bonus items. A collage by Beatriz Milhazes entitled *O Paraíso* (Paradise) represents the Mystery of Life as a kind of Club Med travel poster to a tropically chaotic world of fluid dynamics and diffusion reactions,

<sup>11</sup>Alternating with a nervous blood red and a steady sky blue. The library includes works by Poincaré, Helmholtz, Heraclitus, Archimedes, Darwin, Galileo, and many others, including Grothendieck's *Récoltes et Semailles*. Edifying excerpts are projected helpfully onto the wall, translated into French and English.

<sup>12</sup>In “David Lynch keeps his head”, *Première*, September 1996.

featuring a jaguar, a red parrot, a peacock, fire, and an enormous wave, each tagged by the relevant equation. Lynch offers a high-contrast handheld brooding film of the glowing hands of Bruno Mansoulié, a physicist at CERN, drawing Feynman diagrams, punctuated by occasional real-time interruptions by an instrument panel at the Large Hadron Collider (the very small) or the Planck satellite (the very large): the *Laws of Physics*. When Mansoulié has finished his lecture, Patti Smith's off-camera voice recites Gromov's text on the four mysteries; the "Mother Courage of Rock" (as Luc Sante called her recently in the *New York Review of Books*) adds poetry as her own choice for fifth on the list. The Mystery of the Brain is displayed in the form of "Artificial Curiosity", a "tribe of young robotic creatures" modeling Gromov's concept of an ergosystem. The creatures are meant to interact with spectators and learn in the process, "an experiment" (the press packet informs us) "that will allow the [...] scientists [from INRIA and the Université de Bordeaux] to advance even further in their revolutionary research program." This mystery, unlike the first two mentioned, is actually quite entertaining<sup>13</sup>—the ninth graders visiting with their math class told me it was what they liked best—but its only obvious connection with contemporary art is the plastic head designed by Lynch, reminiscent of the skull of the baby in *Eraserhead*, topping each of the artificially curious robots.

The week the exhibition opened was a special one, with a six-page spread on Grothendieck in the French edition of *GQ* and recent Fields Medalist Cédric Villani identifying himself as "the Lady Gaga of mathematics" in the weekly middlebrow culture magazine *Télérama*. The interview mentioned Villani's participation in the Cartier exhibition, but like most of the press coverage, had very little to say about what was on display. For this you have to read the blogs, where comments like this one are typical:

En effet, une expo très décevante! Artistiquement rien de plus que décorative et mathématiquement totalement superficielle, une imposture qui cultive le mysticisme autour des maths....Ne perdez pas votre temps à y aller.

Mathematicians were divided between those so put off by the *com* style of the exhibition's promotion that they threw away their complementary

<sup>13</sup>As is the infographic display in the same room that projects a sampling of the *Mystery of Mathematical Structure* (Penrose tilings, Euclidean geometry, Ulam's spiral of prime numbers, calculations in the symbolism of traditional Chinese and Japanese mathematics) in brilliant colors at dizzying speed. But when art meets mathematics, why does the result resemble nothing so much as high-tech advertising?

tickets and those who thought that any widely publicized event that brings mathematics to the attention of the general public deserves the benefit of the doubt. What I haven't heard from French colleagues who have been to the show are thoughts about the relations, if there are any, between art and mathematics. No one seems to have noticed what a paradox it is to hear mathematicians claim without hesitation that beauty is the object of their work—not that it's so easy to attribute a precise meaning to this claim, and in a technical sense it's pretty clear that Gromov, Lynch, and Smith were aiming at the *sublime*—in an institution "for contemporary art" where that sort of talk is generally considered to be beside the point. *Notices* readers don't need to be told that the word "art" in the contemporary world is extraordinarily inclusive, but it seems to me that what it designates needs at a minimum to be capable of being incorporated in some sort of dialogue with traditional and historical uses of the word. If such a dialogue is under way at the Fondation Cartier, I was unable to detect it, and I am tempted to define *com* as precisely the form of dialogue in which opinions travel in one direction only.

The exhibition continues downstairs with a sculpture of a surface of constant negative curvature by Hiroshi Sugimoto, culminating at its apex in what is supposed to represent a singularity at infinity, spectacular but somehow pointless, enormous and yet much too small for the room in which it is displayed. Jean-Michel Alberola's contributions are especially unconvincing: a mural representing a conceptual map of Poincaré's work and yet another film of hands writing equations, belonging this time to Villani.

If you look elsewhere than in *A Beautiful Elsewhere* you can easily find evidence that Alberola is in fact an interesting artist, like the others participating in this cross-cultural experiment, and you are likely to wonder about a quite different mystery: how the collaboration of so many undeniably talented people, artists and mathematicians alike, gave rise to such an exercise in futility. Could it be as simple as this, that the relations between mathematics and the arts (such as they are) do not develop in interesting directions when *com* is the catalyst? My thoughts returned to Grothendieck, whose story is an extraordinary gift from mathematics to world culture that remains to be unwrapped. I used to think that David Lynch would be just the right artist to find the images to go along with words like these:

Peu à peu au cours de la réflexion se révèle ce qui, dans ma vie, a été comme le "noyau dur", le centre redoutable de ce mystère, comme le coeur même de "l'énigme du Mal": la violence qu'on peut appeler "gratuite", ou "sans cause", la violence pour le seul plaisir,

dirait-on, de blesser, de nuire ou de dévaster—une violence qui jamais ne dit son nom, feutrée souvent, sous des airs d'ingénuité innocente et affable, et d'autant plus efficace à toucher et à ravager—la “griffe dans le velours”, délicate, vive et sans merci.<sup>14</sup>

But now I'm not so sure. It's a long way from Club Med to Club Silencio, the iconic theater of guilty conscience that marks the tremulous passage between two worlds (or two mysteries, if you prefer) in Lynch's *Mulholland Drive*. Or maybe not such a long way: only a half-hour metro trip from the Fondation Cartier to Lynch's new Paris nightclub, also called Club Silencio. All of the artists represented in *A Beautiful Elsewhere* have worked with the Fondation Cartier previously, in some cases more than once. Those who don't live in town presumably have their reasons to come to Paris. Lynch, “based off and on...for the last four years” in Paris, according to a recent *Guardian* interview, is an Officier de la Légion d'Honneur; Smith was named Commandeur de l'ordre des arts et lettres, in part for her appreciation for Rimbaud. Nobody seems to have been inconvenienced by Cartier's *dépaysement*; it's even mentioned as a footnote to the *Guardian* article, which focuses on Lynch's new CD, *Crazy Clown Time*, and on his enthusiasm for transcendental meditation:

“Légion d'Honneur! Légion d'Honneur!” Grothendieck was shouting from the back of the auditorium, waving a paper facsimile of the Légion d'Honneur cross. ...Grothendieck then mounted the podium and began speaking against NATO support for the conference.<sup>15</sup>

The final basement room is devoted to a 32-minute documentary, entitled *Au bonheur des maths* (The Joy of Math?), by Raymond Depardon and Claudine Nougaret, consisting of eight 4-minute interviews, each devoted to one (or in one case two) of the participating mathematicians: Sir Michael Atiyah, Jean-Pierre Bourguignon, Alain Connes, Nicole El Karaoui, Carolina Canales Gonzales and Giancarlo Lucchini, Misha Gromov, Cédric Villani, Don Zagier. The mathematicians, mostly shown in extreme closeup against neutral backgrounds, bookshelves, or blackboards, say what's on their minds with the authenticity one expected from Patti Smith, the humor one expected from Takeshi Kitano (whose contribution to the Room

of the Four Mysteries is not even worth mentioning), the sensitivity to the uncanny one expected from David Lynch. I was particularly impressed by Villani's segment—he displays a real sense of dramatic timing in explaining how he rediscovered the triangles of his adolescence after two decades of mathematical research—and by Gromov's paradoxical observation that mathematical thinking and biological evolution move in opposite directions. But the speakers were uniformly thoughtful, articulate, and appealing; the film, in which the presence of the artists is reduced to a bare minimum, almost redeems the exhibition.

It's probably pointless to ask Pedro Almodóvar to film Grothendieck's life. If you've seen Almodóvar's *Talk to Her*, you'll remember the scene where Caetano Veloso delivers an indescribably beautiful rendition of a Mexican folk song in an improbably beautiful private garden to a select group of impossibly beautiful “beautiful people”. If I've learned anything from the exhibit at Fondation Cartier, it's that such scenes take place in real life as well. But I learned that indirectly by reading an article published in *Le Monde's* magazine *M*. On the Friday following the opening, Patti Smith read Swinburne's *Loch Torridon*, accompanied by David Lynch on electric piano, before a select group of guests sitting on the floor of the Fondation Cartier—probably in the basement room where the Depardon-Nougaret interviews are projected during the day. *M's* reporter “had the impression of attending a proof *in situ* of the theorem [sic] on two parallel lines that never meet.” Attending were actress Isabelle Huppert, actor Vincent Lindon, filmmaker Agnès Varda, and a scattering of local celebrities, but whether or not any of the mathematical stars of *Un dépaysement soudain* was considered beautiful enough to number among the two-hundred guests and to join them for the after party at Club Silencio, none was beautiful enough to merit mention in *Le Monde*.

A few years ago I saw another film by Depardon and Nougaret in that same basement room. Entitled *Donner la parole*, translated as “Hear them speak”, practically the same length as *Bonheur des maths*, the film consisted of monologues by people from literally all over the world, describing in their own languages their cultures and ways of life, all threatened with extinction. I hope it was a coincidence.

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<sup>14</sup>Récoltes et Semailles, p. 923.

<sup>15</sup>From Allyn Jackson's 2004 Notices article, already cited. The scene was the 1972 Antwerp summer school on modular functions, and Grothendieck was interrupting Jean-Pierre Serre, who had recently been named to the Légion d'Honneur. It was one of his last appearances at a mathematics conference.