

POPULARIZATION AND SCIENTIFIC CONTROVERSY

The Case of the Theory of Relativity in France

MICHEL BIEZUNSKI

1 Boulevard du Temple, Paris 75003

The Best Moment to Study Popularization

The novelty of a scientific revolution is marked by the absence of consensus among the scientific community. A new perspective is not accepted immediately: there is the time of debate. It can last from several months to several decades. The question of the exposition of the theory during that period is not a trivial one. When there is no consensus, the usual scheme of popularization cannot be applied: it is no longer a neutral means of transmission of knowledge: popularization becomes a part of the struggle to make the new ideas accepted. In most cases this process is limited to scientific circles. Nevertheless, it sometimes happens that the debates also take place among the public at large. In such a context, what is at stake in popularization is revealed with more evidence. This has been the case with Einstein's theory of relativity.

Popularization is usually considered as a positive means of transmitting knowledge from those knowing something to those knowing less. The subsequent problem is then: how can one express in simple form scientific ideas or results in order to be understood by the greatest possible audience?

Perhaps this scheme of "translatability" works in a "normal" situation where scientists have made a "good" discovery and want to communicate it to the widest possible public. But it does not work if the discovery is not considered to be a good one by the majority of the scientific community. Yet the activity of popularization subsists and may encompass something else.

When I started to work on the reception of the theory of relativity in France, I thought the study of the texts of popularization could explain the many errors and misunderstandings concerning Einstein's theories and find the origin of the so-called paradoxes. But I discovered something very

different. The definition of popularization as a simple transmission of knowledge from scientists to the lay public had to be altered.

The Theory of Relativity: A Unique Case

Nowadays the special theory of relativity is considered a part of "physics orthodoxy" and is seen as a basic theory by a majority of physicists. It is viewed as a classic work and integrated with general knowledge. But this has not always been true. It took a long time – almost half a century – for the theory, often considered as "hazardous metaphysical speculations", to become recognized by the majority of working physicists.

Simultaneously, for laymen, the theory of relativity was covered by a mythical veil: because of its fantastic consequences, it seemed very unlikely. "One must be a genius to understand Einstein", went the legend. This reputation originated in fact within the scientific community itself. In spite of the support of the major physicists of the twenties, the majority of their colleagues considered it too removed from their previous knowledge to become motivated enough to spend time studying it. The issue of incomprehensibility was a key, and was used as an argument against the theories. Attention has to be paid to this point, considered not as a fact, but as a problematic question in itself. It has to deal with popularization, as well as with the reception of the theory among the scientific community.

The corpus I used is centered on Einstein's visit to Paris. It lasted two weeks, from March 28 to April 10, 1922. Einstein came for scientific exchanges, because Langevin – his main follower in France – worried about the gap between the development of modern physics and the delay taken in the introduction of these new ideas in France.

Science Becomes Fashionable

Einstein's visit made a sensation. Relativity was in fashion. The newspapers were filled with photographs, anecdotes, cartoons, controversial opinions and popularization articles on Einstein and the theories of relativity. His visit was seen, by some newspapers, as a matter of political scandal, because the boycott of German science was still on (it lasted from the end of the First World War until 1926).

The questions raised by Einstein's theories created great excitement. By their very content, the issues of time and the finitude of the universe were caught up in "up to date" preoccupations; these were also found in literature and art. This situation has to be related to the post-war atmosphere. It was considered a necessity to have a cultural "breath of fresh air" after all the suffering caused by the war.

People felt excited by the fact that agreement had not been reached within the scientific community. This did not happen very frequently and was an event in itself. Science, still influenced during that period by the scientific doctrine, was expected to produce certainties. The experimental method, in the form propounded by Claude Bernard, appeared as a "dogma" that was to overthrow religious ones. This reason explains why statements in the press saying that physicists themselves were unable to understand modern physics could have appeared as something puzzling in the public's eyes. For example, a physicist, who remained anonymous, said in an interview with a journalist (1):

I would certainly have understood Einstein (...) if Einstein had expressed himself in the international language of scientists, i.e., by means of a blackboard and a piece of chalk. But Einstein didn't want to use any formulas, because, by expressing himself in a foreign language, he wanted to be understood by journalists, the 'gens du monde' (fashionable society) and 'polytechniciens'. Thus, he came among his own but they didn't recognize him.

This statement can be interpreted in two ways. At first sight, it can be seen as a rejection of Einstein and his ideas for the reason that he didn't behave the way he should have. On another level, this represents an example of a physicist betraying in a mass-circulation newspaper his own ignorance of contemporary physics. This second point is the most amazing, albeit involuntary.

Order was troubled in that "everybody" (2) wanted to know what Einstein's theories were about. But there was a problem: a scientific controversy was going on among the community, and not every scientist was willing to face the challenge of the public: the credibility of science was at stake. The public could see not only that there was no scientific agreement, but also that the arguments used by scientists to fight ideas were not always noble and intelligent. Scientists themselves were considered to be subject to political or cultural contingencies. Scientific truth was questioned, as well as scientific practice.

Scientific Disagreements

Scientists' reactions towards relativity were very diverse, and can be placed on a continuum between full agreement and full disagreement. One can nevertheless distinguish four general characteristic attitudes:

- The first was that of enthusiastic, and often active, support. That was the case, for example of Paul Langevin. But as a physicist, he remained an exception along with Jean Becquerel and a few others. The main followers of the theory of relativity were mostly mathematicians or mathematical physicists, Elie Cartan and Emile Borel for example. Langevin's lectures at the Collège de France, however, were followed by only a handful of scientists, the majority remaining outside of his influence.

- Neutrality represented the second type of attitude, consisting in weighing arguments for and against the new ideas. Such was the position of Paul Painlevé, a prominent mathematician very influential because of his major political role. He had been Prime Minister during the First World War and was to become Prime Minister again in 1924. The opinion he expressed in one of the most widely-read newspapers, *Le Petit Parisien* (in the April 1, 1922 issue) can be summarized as follows: Einstein's theories represent a major challenge for scientists. They have to be seriously taken into account, and with all the attention they merit. But one has to be careful and not adopt them too quickly.

- The third attitude was that of active ignorance. Some scientists were simply not interested. They did not see why they had to change their methods, their way of thinking. They were trained in the classical tradition which appeared to them as a solid construction. Although this attitude might have been the major one, no professional trace remains, due to the fact that they had nothing specific to say ... except in the newspapers of course. The atmosphere of the time can be reconstituted from the newspapers' material.

- The 4th attitude was that of hostility. E. Guillaume, for example, came specially from Switzerland to Paris to exchange arguments with Einstein. He refused to admit that the absolute time of classical mechanics should be abandoned, and proposed to consider a relative speed of light instead. Other opponents didn't present such sophisticated arguments. Henri Bouasse, a distinguished physics professor, defended "laboratory physics" against "metaphysical speculation" (3). Einstein's theory was considered to be an

hallucination by C. Cornelissen, who wrote a very violent pamphlet with anti-Semitic accents (4).

Even the experimental records, supposedly capable of settling the quarrel, were interpreted in quite different ways (5). It was not possible to try to make people believe in the possibility of any "objective" point of view in such a troubled period.

Attitudes Towards Popularization Reflect the Same Disagreements

The four above-mentioned attitudes had an effect on how people conceived the possibility of popularization of the theory of relativity.

Popularization articles were written by scientists committed to Einstein's theories. During Einstein's visit, Langevin gave a public lecture for students that was attended by more than 1,000. His long paper won enthusiastic support from the audience. The text, published one month later (6), remains a very good example of popularization (which could even still be used now, especially concerning the special theory).

Painlevé's attitude towards popularization reflected, on another level, the ambiguities he expressed about the scientific value of the theory. He wrote in *Le Petit Parisien* (7):

It would be unjust to consider with contempt the passionate interest raised, in all milieus, by the theory of relativity; even when it appears in a somewhat turbulent form, it responds to the most noble instinct of humanity, its anguish in face of the unknown.

But Painlevé's favorable opinion to large diffusion of new ideas was tempered by this statement

When doctrine is as difficult to penetrate as Einstein's, those who adopt it by enthusiasm risk being less attracted by the profound truth it contains than by the errors of interpretation that it could produce. It is like a wine that is too strong, and which befuddles those brains insufficiently trained by severe discipline.

Painlevé's attitude toward popularization was therefore rather ambiguous. On the one hand, he understood that people could be interested by Einstein's theories. On the other hand, he warned them against possible abuses, in a paternalistic and reassuring manner, that suited a great scientist and former Prime Minister. The quoted sentences constituted the introduction to an article in which Painlevé described the broad outlines of the life and works

of Albert Einstein. A few days later, a journalist replied to him in *Le Figaro* (8):

I read with great interest a remarkable article by M. Painlevé. It seemed to me that the prominent mathematician wanted to make us feel that laymen have to abandon hope of being initiated to the sublime hypotheses of the master.

I thus conclude that these theories have not yet been able to be applied to any tangible phenomenon, that they float far above us in the irreality of abstractions and that later only our nephews will see them applied to concrete uses.

I also understood that there is no longer any ether, which will certainly suppress the etheromaniacs. I did not understand anything else. This is not enough to be invited for dinner.

This reply to Painlevé is interesting because it gives an idea of the impact produced by such an article. The ambiguity of Painlevé's attitude towards the theory influenced his attitude towards popularization. This statement may seem obvious, but texts expressing this possibility of popularizing so clearly are rather infrequent.

The attitude of the opponents of the theory also found an echo in what they say about popularization. Bouasse, for example, considered the theory to be incomprehensible for physicists. This prevented any possibility of popularization for a larger public (9): "In the end we, the laboratory physicists, will have the last word: we accept the theories that are comfortable for us. We refuse those we cannot understand and, for that reason, are useless."

But the most interesting phenomenon was the side-effect produced by the indifference ("active ignorance") of the majority of physicists towards new science. It makes popularizers face a delicate situation: they were not able to fulfill their task, because they did not find the sources. It was most embarrassing for them because of the multiple signs of public interest. Many journalists thus described what they saw happening before their eyes, and tried to find explanations of that situation.

Consider the following example (10):

I do not want to obtain an advantage from it. But I didn't understand anything about Einstein's theories. I must admit that I did not listen to him; I have only read articles of competent people who, perhaps, did not understand much more of them.

Some popularizers found they had to explain what they usually meant by popularization. For example one can read, in an article published in *L'Ere nouvelle* (11):

It is somewhat presumptuous – and ridiculous – to pretend, as an unfortunate journalist, to possess and explain Einstein's system.

Nonetheless, the average public, which also is not familiar with transcendental mathematics, likes to find in a newspaper an indication, a note, a hint, something superficial but precise, which helps them to not seem too poorly informed when these problems are discussed in their presence.

This "confession" is particularly interesting because it reveals the conception of popularization of a popularizer. What was important for him was not for the public to be informed, but to seem informed in order to talk. This implied that the public accepted the renunciation of access of scientific knowledge, considered almost sacred, or at least the private property of the élite.

The interest of the majority of scientists was the same. Because they did not see any profit in studying these strange ideas, it was important for them, in order to keep their special positions as scientists, to maintain the gap relative to the laymen's level of knowledge. For that reason, popularization was not a means of gaining knowledge (one does not become a scientist by just reading popularization articles in the daily press – or even in the scientific popularization press). On the contrary, popularizers perceived their role as preserving a certain kind of order troubled in a period of scientific revolution.

This can be illustrated by the following two examples:

I declare being totally unable to get a personal idea of the value of Einstein's theories. The kind of questions he is dealing with are infinitely beyond my skills and don't interest me. But it is undeniable that very elevated minds are concerned with them (12).

We believe in science and we contemptuously maintain that outside of it there is no metaphysics, no philosophy. We do not always understand it, but we know that we could do so and this is enough. (...) Einstein speaks and we accept not knowing what he is speaking about, as long as Mr. Langevin and Mr. Borel assure us that it is true (13).

This order is not exactly social order, because the different categories cannot be distinguished simply by their social class in an economic scheme. It can be rather called a "socio-epistemological order", in that it differentiates categories according to the kind of relationship they have with knowledge.

Thus, the main preoccupation for popularization is not to make new ideas known, but to use any possible means to maintain this order.

Science as an Explicative Process

Maintaining the order of the hierarchy to the access of knowledge is valuable for the social standing of scientists, but can be a brake on the advancement of science.

This means that attitudes towards popularization have direct consequences for attitudes towards science. The lack of interest shown by some scientists spares them the effort of questioning their theoretical bases and prevents any kinds of popularization. Thus, the consequence of this situation is an attempt to "retain" knowledge. This is the opposite of the vision of science as being motivated by the will to knowledge. The philosopher Emile Meyerson (14) opposes "science for knowledge" to "science for action" and related the second term to the positivist interpretation of science, where searching for laws describing phenomena leads to a utilitarian point of view. In his major book *De l'Explication des Sciences* (15), he states that explanation is located in the very heart of scientific activity. Explanation constitutes the source of rationality. Science is then acted upon first of all by curiosity, the desire of knowing.

And, from this point of view, this is exactly the same motivation that leads anybody to read popularization articles. The public of popularization is composed of people who want to know more about nature. Within that perspective, there is a similarity between science and popularization.

But there is something else which constitutes the distinction. It is the question: what does the desire of knowing become? When a scientist discovers a new phenomenon or when he formulates a new explanatory theory, he is fully conscious, at that moment, of the immensity of the things he does not know. That's true, of course, even if he is not discovering anything! It is like the construction of the polders in the Netherlands: the sea recedes, but is still there; one can see it and the Netherlands would not be the Netherlands without the sea. Scientists can support the existence of the "ocean" of the unknown, because they live from it.

The Two Barriers

In the struggle for popularizing the theory of relativity, there are not only two "opposite camps": scientists and the lay public. These categories are not

distinguishable by the quantity of knowledge they possess – a plumber also possesses a part of knowledge – but by the way they cope with their desire of knowing.

From this point of view, it appears that there are not two categories, but three: scientists, the ignorant and a third category which is referred to in French as "les gens du monde", or "fashionable society", and which represented an influential group in France in the early 1920's. This category is satisfied with the awareness of not knowing. It can be characterized by its art of using language: these people talk and write a lot. Journalists and popularizers are included in this category: it is not their job to know everything. But they must be able to talk about any subject.

Thus the question here is no longer that of knowing, but of making others think one knows. The "gens du monde" felt comfortable in sharing with others a common position of not knowing. In an article, probably written by the essayist Julien Benda (16), one can read:

It seems in such a case that the mutual activity of being up to date, and the encouragement we give each other are like a revenge for the force abdication from our knowledge. We have less remorse in admitting this when we feel that we share it with a great number of people; we will even come to experience a strange feeling of satisfaction from contemplating crowds united with us, in the adoration of an idol incomprehensible to all of us.

There is thus a secondary advantage to the non-accessibility to knowledge.

Scientists were fully conscious of this fact, especially those who did not want to consider the theory of relativity. This explains why one finds in the press so many statements qualifying every man or woman interested by Einstein's theories as "snobbish". This opinion was sufficient to reject the desire expressed by the "gens du monde" for knowing what was going on in the area of physics.

Finally, the credibility of science was at stake. It is not the fact that theories necessarily follow one another which disorients people, but rather the high visibility of the differences dividing the scientific community. Scientism was the target, in the sense of being the affirmation of the infallibility of science, of being the possession of a truth able to destroy religious truths. The fact that epistemological questions were publicly discussed weakened the force of the dogma. In this manner, Einstein's theory introduced a critical dimension into the very heart of physics.

The "result" of the struggle was the following. Attempts were made, on the one hand, to keep the order established at a socio-epistemological level. On the other hand, accepting the revolutionary ideas expressed in physics was a necessary condition for the development of science in France. It is difficult to precisely establish the winner. Scientism was actually on the decline as an ideology, but science was to become recognized as a fully professional activity. France was absent from the new challenge of the mid-1920s and 1930s, quantum physics. Perhaps this could be related to the choices made concerning Einstein's theories – considered as revolutionary physics – among the majority of the scientific community in France. Popularization was a crucial point at the very heart of the debate.

Notes and References

1. J'aurais sans doute compris Einstein, me dit ce physicien, si Einstein s'était exprimé dans le langage international des savants, c'est-à-dire par le truchement d'un tableau noir et d'un morceau de craie. Mais Einstein n'a pas voulu employer de formules, car il a voulu, s'exprimant dans une langue qui n'est pas la sienne, se faire entendre des journalistes, des gens du monde et des polytechniciens Ainsi, il est venu parmi les siens, et les siens ne l'ont pas reconnu." G. de la Fouchardière: 'Relative-ment', *L'Oeuvre* (2 avril 1922), p. 2.
2. By "everybody" I refer to the term frequently used in the newspapers to qualify the public interested by Einstein's theories. In fact, it represents only a certain category of people, "les gens du monde", whose characteristics will be developed later in the text.
3. H. Bouasse, *La question préalable contre la théorie d'Einstein*, Paris: Librairie A. Blanchard, 1923.
4. Christian Cornelissen: *Les Hallucinations des Einsteiniens ou les Erreurs de méthode chez les Physiciens Mathématiciens*, Paris: Librairie A. Blanchard, 1923.
5. The discussion held during the April 3, 1922 session of the Académie des Sciences was over an experiment by Pérot on the gravitational redshift of solar metals. Very different comments were made on the value of confirmation of this experiment.
6. Paul Langevin: 'L'aspect général de la théorie de la relativité', *Bulletin scientifique des Étudiants de Paris*, no. 2 (avril-mai 1922), 2-22.
7. "Il serait d'ailleurs injuste de traiter avec dédain l'intérêt passionné qu'excite, dans tous les milieux, la théorie de la relativité, même quand il se manifeste sous une forme un peu turbulente, il répond au plus noble instinct de l'humanité, à son tourment de l'inconnu. Mais quand une doctrine est aussi difficile à pénétrer que celle d'Einstein, ceux qui l'adoptent d'enthousiasme risquent d'être moins attirés par les vérités profondes qu'elle recèle que par les erreurs d'interprétation auxquelles elle prête. Elle est comme un vin trop fort, qui grise les cerveaux que n'a pas entraînés suffisamment une sévère discipline." Paul Painlevé, 'Einstein', *Le Petit Parisien* (1er avril 1922).

8. "J'ai lu avec attention un remarquable article de M. Painlevé. Il m'a semblé que l'éminent mathématicien se proposait de nous y faire sentir que le vulgaire doit renoncer à l'espoir d'être initié aux sublimes hypothèses du maître.
J'en conclus que ces théories n'ont pu encore être appliquées à aucun phénomène tangible, qu'elles planent bien au-dessus de nous dans l'irréalité des abstractions et que plus tard seulement nos neveux les verront appliquer à des usages concrets.
"J'ai compris aussi qu'il n'y avait plus d'éther, ce qui supprimera sans doute les étheromanes. Je n'ai pas compris autre chose. C'est insuffisant pour être invité à dîner." Janot, 'Notes d'un Parisien', *Le Figaro* (6 avril 1922), p. 1.
9. "En définitive nous, les physiciens de laboratoire, aurons le dernier mot: nous acceptons les théories qui nous sont commodes; nous refusons celles que nous ne pouvons comprendre et qui par cela même nous sont inutiles." H. Bouasse, *La question préalable contre la théorie d'Einstein*, op. cit.
10. "Ce n'est pas pour me vanter: mais je n'ai rien compris aux théories d'Einstein. Il faut dire que je n'ai point entendu Einstein et que j'ai seulement lu les articles des gens compétents qui, sans doute, n'y avaient pas compris davantage." V. Snell, 'Oiseaux de nuit', *La Lanterne* (4 avril 1922).
11. "Il y a quelque outrecuidance – et quelque ridicule – de la part d'un malheureux journaliste, à prétendre posséder et expliquer le système d'Einstein.
"Pourtant, le moyen public qui, lui non plus, n'est guère familier avec les mathématiques transcendantes, aime bien à trouver dans un journal une indication, une note, une fiche, quelque chose de superficiel, certes, mais de précis tout de même, qui l'aide à ne pas avoir l'air trop mal informé quand on agite devant lui ces problèmes vertigineux." Milliardet, 'Pour comprendre Einstein – Qu'est-ce que le temps? Qu'est-ce que l'espace?', *L'Ere nouvelle* (30 mars 1922), p. 1.
12. "Je déclare être complètement hors d'état de me faire une idée personnelle sur la valeur des théories d'Einstein. Le genre de problèmes où il s'évertue est infiniment au-dessus de ma compétence et ne m'intéresse pas. Mais il ne saurait être contesté que de très hauts esprits s'y évertuent." André Lichtenberger, 'Einstein à Paris', *La Victoire* (28 mars 1922).
13. "Nous croyons en la science et nous professons dédaigneusement qu'il n'y a ni métaphysique, ni philosophie en dehors d'elle. Nous ne la comprenons pas toujours mais nous savons que nous la pourrions comprendre et cela suffit. (. . .) Einstein parle et nous supportons de ne pas savoir ce qu'il dit pourvu que MM. Langevin et Borel nous assurent que c'est vrai." Gonzague Truc, 'La Religion de la Science', *La Grande Revue* 26 no. 4 (avril 1922), pp. 315-317.
14. Emile Meyerson, Lublin, 1859 – Paris, 1933 played a major role in the debate over Einstein's theory of relativity. His book, *La déduction relativiste*, Paris: Payot, 1925, provoked reactions: Einstein was very favorable (see A. Einstein: 'A propos de la déduction relativiste de M. Emile Meyerson', *Revue philosophique*, 1928, CV, 161-166) whereas Bachelard wrote a book aimed at refuting his arguments (see G. Bachelard, *La Valeur inductive de la théorie de la relativité*, Paris: Vrin, 1928).
15. Emile Meyerson, *De l'explication dans les Sciences*, Paris: Payot, 1921.
16. This article entitled "Snobisme nouveau" was published in *Le Temps* (April 7, 1922), p. 1. It is signed J. B. The reasons that lead me to think that it is Julien Benda is that he published in *Le Gaulois* (October 28, 1921), an article entitled 'Einstein et les salons', which is about the same kind of subject and in the same

style as the article quoted. "Il semble que dans un cas semblable, l'entraînement mutuel à se mettre au ton du jour, l'encouragement que l'on se donne les uns aux autres soient comme une revanche sur l'abdication forcée de notre ignorance. Nous avons moins de remords à avouer celle-ci lorsque nous la sentons partagée par un grand nombre de personnes; nous finirons même par goûter une étrange satisfaction à contempler des foules entières qui s'unissent avec nous, dans l'adoration d'une idole incompréhensible pour tous."

