The state of math
A CNRS video

Jean-François Mela : Now, it is clear that mathematics will play a fundamental role in technological development, and that this concerns their general development, and not just restricted applications on particular technical problems.

Jean-Pierre Bourguignon : An example that is close to my heart, for example, is the really frantic search for mathematicians carried out by a certain number of computer companies, which are interested in computer graphics. And right now, big companies are looking for people with geometry training, and looking for PhDs in mathematics with geometry training because, for computer-aided design, for visualization systems, the problems encountered are not only technological problems, but are fundamental geometry problems. And that is for us, mathematicians, a completely new thing to discover, to see computer manufacturers calling laboratories to say to them: “Listen, don't you have a doctor in mathematics to provide me?”. So, we are initially surprised; then, we look, and indeed, what they need is a mathematician, not a computer scientist. Of course, the team that will do the work will not just be a team of mathematicians, but the mathematician will be integrated into a team of people making hardware, hardware! The way mathematics interacts with other sciences is not only at the level of elementary, fundamental mathematics of a century ago, but including the most recent developments in mathematics, which often have been developments which the mathematicians have made for themselves, but which happen to be exactly what the correspondent in the other science needs. And it is this coincidence which in a certain way is the mediatization between the aesthetic concern of the mathematician and the social utility of mathematics. It is precisely this coincidence which, in my opinion, deserves a slightly epistemological study: how is it that the aesthetic concerns of scientists can correspond to what, in another science, later, or in other conditions, corresponds to a technical necessity. It's something that's a bit of a mystery, but it happens with such regularity that it deserves a pretty in-depth analysis, and it's not easy to do.

Jean-François Mela : I mean that the influence of mathematics in a country like ours is invaluable. It is sometimes said, well, that there is a big success in the software industry, in France. Well, I remain convinced that it is very much linked to a certain form of French spirit, and to a certain mathematical culture. It is

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Transcript of video at https://www.yout-ube.com/watch?v=1YCdRAglFKM, Denise Vella-Chemla, February 2022.

impossible to demonstrate. But finally, we find ourselves in a position where we have, with mathematics, a real natural deposit.

Jean-Pierre Serre : Me, I've been interested in elliptical curves for a very, very long time, for about twenty years, perhaps, or more, and it's only been two or three years since it started to interest people in crypto, sort of topics like that. It's very amusing the idea that it could be used to essentially rob banks, it's delightful. But that's not why the subject interests me, anyway.

Jean-François Dars : And it was dormant for a long time?

Jean-Pierre Serre : No, it wasn't dormant at all. It was very, very active on the contrary. But if you like, it was not known outside of a group of specialists. No, it's at the heart of all number theory questions.

Anne Papillault : Does the use of the computer, or computers, make it possible to brutally solve a large number of problems which have arisen for a very long time and which have not been resolved.

Jean-Pierre Serre : No, to solve... not really, not in number theory, in certain subjects, yes: the famous problem of the 4 colors has been solved by computer. No, but in number theory, what it allows you to do, first of all, it allows you to be much more sure that the conjectures that you make, and which would remain a little in the air, are experimentally true; if you like, for a physicist, it would be a demonstration: we verify a million cases, or things like that, and no exceptions, of course. One exception would be enough to demolish the thing, but... So, that gives us confidence. It also suggests, numerical calculations on a computer, it can suggest formulas to prove: someone who has an eye for that, he says to himself “Hey, how come these things are the same? ! And if we tried to demonstrate it. So it does a lot. But not really demonstrations, no.

Jean-François Dars : Does it allow a round trip?

Jean-Pierre Serre : Oh yes! Continuous. People who know how to use machines, like Mestre or others, they spend their time thinking, on paper, and then they say to themselves “Ah well, well we should go and see on the machine if it works. ! . ! And then they come back, just like an experimenter, to physics.

1. Jean-François Mestre, IMJ-PRG, specialist in the study of elliptic curves and Galois theory.

Henri Cohen : To arrive at discovering these phenomena that I dare to call laws of Nature, it was necessary, to take just one example, I will necessarily be technical here, but it's developed in much more detail in Eniart's presentation this afternoon, the example of the conjectures of Birch and Swinnerton-Dyer, it's something, it's an absolutely extraordinary law which is now at the center of a incredible amount of research at the present time, it is something which could hardly have been discovered without the rather intensive use of computers. So for us, computers are in fact the analog of what are for physicists the accelerators.[2]

2. Spelling?