European Cultural Heritage and the Role of Science and Mathematics

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Professor Dusan Sidjanski

You have seen the small DVD which was my introduction to *Hands On* (*La main à la pâte*). On entering the classroom, I was so impressed to see the children paying so much attention, so absorbed in their work that nobody even looked at us. To our surprise it was as if we were inexistent. As observers we were able to obtain first-hand knowledge of *La main à la pâte* as applied in the classroom, beginning with four to five-year-olds, and after that through discussion with seven to eight-year-olds, and finally the scientific explanation given by the ten-year-olds. In this way, we saw the whole process in practice from beginning to end.

Before starting my presentation, I would like to say that it is a great privilege to have the opportunity to be with you today. Even if I am known as a political scientist, I am not a scientist according to your sense of the word, I am not a mathematician. However, I am convinced that *Hands on*, *Pollen* and *Fibonacci* will play a part in our future. I am very grateful to all of you, but in particular to Leon Lederman and Georges Charpak, the founders of *Hands on*, and also to Pierre Léna, David Jasmin, Yves Quéré and all those who formed a hard core in Europe and spread *Hands on*, and later *Pollen*. This is my hope and belief, that your success will be the success of Europe.

For approximately forty years, I have worked more specifically on European integration. For a long time, I collaborated closely with Denis de Rougemont who was a writer and philosopher who believed in the cultural as well as the political unity of Europe. I have also

worked with many French, American political scientists, and so on. The relevant point today is that José Manuel Barroso was a member of my class for some years and subsequently he was appointed assistant. One day, my secretary announced to me that due to a lack of space in the department, I would have to share my office with one of my assistants. As Director of the Department of Political Science, I chose José Manuel Barroso, and we spent the following three years together in my office. This explains how he was introduced to *Hands on* and the reason for our success with Georges Charpak. When he was elected in 2004, the three of us immediately met in Paris, at Hotel Lutetia. José Barroso, who is a very open, very cultured person, particularly interested in the role of universities - he was formerly a professor at the University of Lisbon – seized the idea and as a result with the help of many of you we have succeeded in creating this programme which is called *Pollen*. But before presenting my view as an outside observer of *Hands on*, I would like to say a few words about Fibonacci.

I was particularly impressed with the stature and the creative mind of this extraordinary man, Fibonacci. I have studied the history of Pisa during the 12th century, which represented its Golden Age. There was considerable development not only inside the city but also throughout the Mediterranean basin. Pisa was at this time a real sea and mercantile power in the Mediterranean and was directly competing with yet entertaining good relations with Venice. In my view, this provides us with a sort of model, proving that in a healthy intellectual, cultural environment you can have genius and extraordinary contribution to culture. To a certain extent, this is the pattern followed by the cities of this time, during the 12th and 13th centuries, at the eve of the Renaissance in Italy. It was a period marked by many important intellectuals such as Burgundio, a man who could speak Arabic, a scholar of ancient Greek, who had travelled extensively and was also a lawyer and an influential personality. At the same time you had the development of sculpture, of architecture, and so on. It is interesting to note that Giovanni Pisano travelled a lot, spreading his knowledge of architecture in Florence and other Italian cities.

It is particularly impressive to see the exchange that existed in this period – the exchange between intellectuals, the interest they had in other cultures - and this was the case for Fibonacci, who, as you know, was the son of a merchant. As a young boy he accompanied his father, visiting various countries, Tunisia, Egypt and Greece, getting to know new civilisations, such as Arabic and Greek. Through this contact with other civilisations and cultures, he was attracted by mathematics and the result, as you know even better than me,

was the book he published at that time called *Liber Abaci*, and which was to have an enormous influence. Even today, Fibonacci waves are being applied in the world of finance. This doesn't mean that as a result financiers are making a fortune. However it does mean that Fibonacci is still alive among us, and as you chose this name for this project, it proves that we can learn a very important lesson from him, namely the contribution of different disciplines and flourishing cultures during the Golden Age of Pisa.

This raises the question, what is *culture*, what do we mean by *culture*? I think that our heritage shows that our culture consists of an ensemble of religion, philosophy and arts. Political organisation, moral or ethical views, judgements, the principles of democracy, of citizenship, languages, music – as you said before, our culture is all these things but it is also mathematics, science and, to an increasing extent in today's world, it is technology. So the important lesson to be learnt is that culture is a global view, and it is essential that this is taken into account when teaching *Hands on*, so that children know that they are participating in something global and not just particular to their individual world. This is the first point. The second point is that our culture has always been open to new influences. If you take the Greek period, in many countries, as for example when Alexander went to Asia, Greek culture was being spread around, but at the same time it was assimilating important parts of other cultures. We never refuse to be open. This is a major difference with the Chinese culture, which after having extraordinarily flourished during certain periods, suddenly closed itself to the outside world for centuries. We have our way of thinking and in our cultural environment, discoveries and the progress of science are all possible.

As an outside observer of *Hands on*, I would now like to address the objectives of this method. Of course, it aims to stimulate the interest of children in science, to explain by experimental method. But another objective is to make education more accessible, by enabling a lot of young people to be educated and to go on to higher education. We are building a new knowledge base in our society. This is in line with the concept of the Lisbon strategy, creating a knowledge society in Europe. The second point which is of course very important is the quality of knowledge. The aim is not only to spread knowledge, but also to guarantee the quality of what is learned during the experiments. The third point, in my view, is that children have the capacity, as we observed, not only to discover, to prove, to make hypotheses, to reason scientifically using logic, but also to discuss, to communicate amongst themselves, to have arguments. You have seen in this DVD how they explained to us what

they were doing. They have to record, explain and argue their findings. As a result, they gain respect for one another. This mutual respect is not based on status or background, but rather on personal capacity. When the Chinese Vice-Minister of Education visited with Charpak some schools where children were practising *La main à la pâte*, she commented that they were learning in the best way the practice of democracy. In fact, their discussions and a sense of respect for one another's ideas are fundamental principles of citizenship in our democracies and in the European Union. Personally, I was also very impressed to see to what extent the children developed the highly promising ability to express themselves logically and to communicate their arguments. This method of learning is indeed extraordinarily open and dynamic. On the other hand, it also imposes a new role on the teachers. They have a major part to play, like the conductor of an orchestra, guiding without dictating. They are involved in the discussion with the children, trying to answer their questions, to respond to them. If they cannot reply, they propose consulting other sources to obtain an answer. In France there is a scientific committee, the role of which is to communicate by Internet with the teachers and to provide answers to some questions.

Another very important effect of this methodology is less violence in the classroom. More attention is given to others, to what they are learning, and as a result in schools formerly renowned for their violence, for example in the Chicago suburbs or in a school in Vaulx-en-Velin in France, considerable progress has been made regarding social integration. This is one of the aspects which leads me to say that *Hands on*, *Pollen* and I hope in the next few years *Fibonacci*, will become essential for the spreading of certain fundamental European values throughout the European Union and generally around the world. A change is occurring, and I believe that this methodology will promote not only better standards of knowledge, but also better standards of living in our society and greater cooperation. As a result, Europe's capacity to compete with other powers will be enhanced. Today's world is completely different - it is no longer dominated exclusively by the United States, or by Soviet Russia. It is more competitive, with emerging powers. In such a changing global and multipolar environment, we have to adapt our knowledge, our analyses and our strategies. Fortunately, we are accustomed to rapid evolution and to a high level of diversity, which is a common and habitual trait of European culture and its adaptation over the centuries. The knowledge society based on our culture constitutes Europe's major asset.

In the beginning, the influence of *Hands on* was limited to the United States and France, but suddenly it started spreading from local, to regional, to national and now to European level. This new perspective implies many advantages. To take the example of history teaching, I have always advocated the need to record history from a European rather than national perspective, encompassing different views. Today, we are lucky enough to have Franco-German history handbooks. They serve as a model for history textbooks from a trans-national perspective and it is my hope that this model will be spread for the teaching of European history in general. For years, the manner in which history has been taught has been a powerful instrument creating national interests and a sense of national identity. Today we are moving towards a sense of European and global awareness. At the same time, *Hands on* serves as an introduction to a more open society. Therefore I believe that our contribution to its implementation and dissemination is fundamental for the future of the European Union and more generally for the future of mankind.

I met Georges Charpak in 1999, and after having observed *Hands on* in practice I became a fervent believer. I am sure that with the support of the European Union we can obtain extraordinary results for the future of our children. A characteristic of *Pollen* which impresses me is the fact that its influence is not limited to the school environment; it aims to involve the schoolchildren's families, and various different official and social actors such as local authorities, businesses etc. This shows that we are thinking in a more global, integrated manner, and we are taking into account our cultural heritage. Another point which impresses me greatly is the fact that different centres have different approaches and after discussing and putting all the results together we can see the interaction of these approaches and the influence of political and social structure. For example, in Brussels the emphasis is on education in low income areas and societies; in Berlin, the main focus is on gender issues; in Leicester there is a cross-disciplinary approach, and this is generally the case in other countries, with family involvement in Loures in Portugal, and active participation by citizens in Perugia. There is of course also participation of the scientific community in all these processes, as is particularly the case in Saint-Etienne in France and in other countries.

The result is the flourishing spread of this project, whose growth can be compared to the Fibonacci number sequence. Of course, the school remains the focal point, but social and scientific actors, artists etc. could be more and more involved in this experience. This is the major influence that your methodology and approach will have in the future for us and I

predict even more important results from the Fibonacci program. It will enable a greater number of people to acquire basic knowledge of science and mathematics and at the same time will provide them with more job opportunities by creating a more qualified and competitive European workforce. The added value of this method is a more global approach and greater involvement of society in this process.

Today's world is constantly changing and *Hands on* prepares the young mind to adapt to new ways of thinking. In my opinion, the impact of internet, of the numerous communication processes and of advanced technology on our society has introduced so many changes that it is extremely important to maintain all these innovations in the framework of our culture. On other continents such as Africa or even Asia, science and technology have been imported and do not always fit into their cultures. In the case of Europe, science, mathematics and technology have been integrated into our culture and I hope that our teachers will take into account this richness and diversity on the one hand, and on the other hand the unity of our European culture. Large-scale regional union and even world collaboration are indispensable if we consider the major problems with which the world is currently confronted. For example climate change, water and energy supply, these are topics which cannot be approached purely on a local level. They have repercussions on a national, European and even global level. Children are interested in these problems, and schools have a part to play in the promotion of the idea of the interaction between climate and energy and our common contribution in the European Union, which will increase in the future.

In Europe today we are used to the fact that we live in peace, and benefit from free movement of persons and ideas. The only obstacles which still remain are the mentalities of people who are still very nationalistic. It is the manner in which we teach science, history and geography which will play a fundamental role in overcoming these obstacles. Moreover, we are increasingly aware that soft power, dialogue and cooperation are much more effective than the use of force. This is Europe's strength - the capacity to become a global actor without using hard power. I believe that our whole system, not only at national but also European level, is based on our common cultural union: our common cultural heritage and its rich diversity are the basis of a European federal union. Unity in diversity is a fundamental principle of the European Union.