Hubert Huppert

Born 1943.
Life story interview by Alan Macfarlane.
Available online at www.livesretold.co.uk

Contents

The text of this life story is transcribed, with thanks and acknowledgement, from the collection of Filmed Interviews with Leading Thinkers at the Museum of Archaeology and Anthropology at the University of Cambridge. The interview was carried out by Prof. Alan Macfarlane on 3rd September 2008, and was transcribed by Sarah Harrison. The video is here: https://www.sms.cam.ac.uk/media/1123184

1. My Parents

I was born in Sydney, Australia, in 1943. My maternal grandfather was a shamus in a Viennese synagogue. Both he and his wife were very religious; I got to know them when they came out to Australia in about 1947-8. The remarkable thing about my paternal grandparents is that I knew nothing about them; my sister and I both assumed that they perished in the Holocaust although we had not been told. My father died when I was thirteen. About seven or eight years ago my sister did some extensive research in the Viennese archives and found that both my paternal grandparents had died natural deaths in hospital in 1935 and 1937.

My father rarely talked about his time in Vienna and neither did my mother. She would talk about St Stephen's dome in Vienna and the giant wheel nearby. When I was eight I bought her a book on Vienna for her birthday with both illustrated on the cover. She was clearly upset by it and I never saw the book again. Many years after when both were dead (my mother died when I was twenty-two) I heard that a few months before they left Vienna my father was told to queue up to get a visa to leave. The night before he was warned that the queue was to be bombed by Nazis; he decided not to join the queue and it was bombed. Two weeks later he did get an exit visa. They left in 1938 and arrived in Australia on 26th January 1939.

When my father died my mother handled it badly and she didn't talk about him. Some forty years later my sister and I got together and for the first time started talking about our father. We found our images of him very different. I remembered him as a gregarious, fun-loving chap and she, as rather depressive and upset. Maybe neither description is correct. I remember him as a wonderful man who would take me boating, and I felt close to him. My mother was a very enthusiastic woman, not at all educated but quite shrewd. She would have done anything to help us.

I felt very close to and loved by both of them; my father had enormous technical skills and was almost a self-taught engineer. It was not an intellectual house in any way though we would discuss news and attitudes. Very different to my own house now where my wife and I discuss intellectual things all the time with my sons.

I think that my father had been trained in a technical high school. When they got on the boat to Australia they had £50. While the boat was waiting to leave Vancouver my mother noticed a man whom she thought might be able to help them. They made his acquaintance and it turned out that he had lots of money but no abilities. They set up a knitwear factory. I heard later that the partner got the company going in the sense that he knew how to bribe shop assistants, so the knitwear was bought by places that would not normally have bought from refugees. My father hated that but was pleased that the company got going.

---

2. My Early Life

My first memory is at three years old being taken to the hospital where my sister was being born. I remember being quite good at arithmetic and having some understanding of English literature as we hired as a housekeeper a woman who enjoyed Shakespeare, and she would recite. I remember the housekeeper showing off in a bank to a friend of my parents that I could tell the time at the age of four. I could also answer the mental arithmetic questions asked by my parents' friends.

I first went to a Jewish kindergarten which I remember with both pleasure and terror. On one occasion the headmaster threatened to put me into a duplicating machine as I had been so naughty and that terrified me. Generally I enjoyed the school and had lots of friends. I then went to an "institution" which my mother chose, which cost about £300 a term. It would have been better if my father had paid the money to charity and sent me to a state school. I hated this institution, Cranbrook, with a passion. I have recently come across two people who went there some ten years after me who thought it was wonderful; one is Richard Hunter who is Professor of Classics here and the other is the new Director of the Fitzwilliam Museum.

The headmaster had come from Cambridge where he got a very low third in mathematics. He was apparently a wonderful cricketer and golfer. He caned me once because I knew more mathematics than he did. I remember when I was eleven a student getting a Commonwealth Scholarship which paid his university fees, and we were given a day's holiday. When I sat for the same scholarship I was disdainful about the level, but Cranbrook had thought it a great achievement. I did have one good teacher who taught mathematics and he subsequently became headmaster. His son, Mark Bishop, influenced my son to become a chemist when he taught him.

Cranbrook was everything that I hated; I went there when I was just six. They were clear that I could add and on that basis put me up a class without ascertaining whether I knew anything else. I found myself a year and a half younger than everyone else and I was nowhere near mature enough. That had a bad influence on me. Later it became better because when I went to a proper school I could run well, but Cranbrook was a terrible institution. I left when I had just reached twelve; I passed the exam to Sydney High and my mother gave me the choice of going there or staying at Cranbrook.

If I had stayed in Cranbrook five more years I would not be here today. They taught badly; they hired a chemistry teacher who was a Nazi who told us how wonderful it had been flying over England and bombing it, and also about the problem of German Jews. It was just unbelievable. There was bullying, but I don't know whether it was anti-Semitic or just bullying of younger people. We were forced to have a shower after P.T. after which we had to dress outside. There was a female music teacher who was constantly looking out at us; there were many things like that.

3. Sydney High School

Sydney High was much better and I can't remember a day of unhappiness there. It was a fabulous school and has produced some brilliant people, including Bob May, President of the Royal Society, and John Cornforth, Nobel Laureate in chemistry. We had an inspiring chemistry teacher, Leonard Basser. He was also the athletics coach and I ran for the school, something what was inconceivable at Cranbrook. I also had a mathematics teacher who was enormously motivating; I realized later that he was not a good mathematician and could not do many of the problems, but it didn't matter. Without him I would not be here. Mathematics was by far my strongest subject and I had intuition in it. Every mathematician I know has had some really motivating teacher early on.

On my second day at Cranbrook I was sent to the music teacher who asked me to sing; she decided that I had no musical ability so would not have any lessons in music. A week later I asked a master if he could teach me to play cricket and he told me to ask my father. As a present to myself aged forty I learnt to play the viola and reached grade five in the music exam. But I don't have any real musical ability; I am not tone deaf and enjoy music in the Chapel. On drama, I was in a few plays in both schools but did not have much ability there; I do enjoy music but the link between it and mathematics is not true for me. I am not obsessed with mathematics but am more interested in the science. Mathematics is a tool by which I can get insights into physical phenomena.

Mine was not a religious household. My mother's parents were observant and Kosher but she rebelled against it. We did keep Shabbat on Friday nights and went to Synagogue two or three times a year. I am Jewish, but not in a religious way; it means culture to me. I was Bar Mitzvahed by a wonderful man, Cantor Deutsch, who also did the same for my children. I would not have considered marrying a non-Jewish woman. I have been the treasurer of the Jewish community here but none of the dogma means anything to me. It is very much cultural, although I do feel rather uncomfortable going into the Chapel as a Jew. I am Jewish and also Australian and have found more anti-Australianism than anti-Semitism in England.

---

4. Sydney University

I went to Sydney University and started doing engineering which I didn't really enjoy. I did that for two years then did science, basically mathematics. I had left school at sixteen and went directly to university. I joined the athletics club but was too young to make much impact. I played squash, but was most interested in mathematics. I did quite well in the third year and in the final year, aged nineteen, did best of all. I had one inspiring teacher; although he could never get his equations correct he could explain the background and then I could work it out myself.

He was from Manchester, a Jew, who had taught in schools, got a PhD and came to Sydney. He was shrewd and I think I learned something about university politics from him. I had another inspiring man who became the chief scientific advisor to the Ministry of Defence in Australia, Tom Fink, who was Professor of Engineering. In my final year I did an essay on turbulence with him. He expressed sadness that I had given up engineering after the second year. I thought my marks were not very good but he looked them up and found there had been a transcription error, and they were much better than those published. I came second in mathematics my third year. Just before my final exams I learned that my third year paper had been marked down unfairly, which had prevented me from being first in the year. In my finals I did come first and got a gold medal.

---

5. University of California San Diego

While a Sydney undergraduate, there was a competition among us to write to American universities asking to be taken on as a graduate student. The winner would be the person who had the most replies. In Sydney the best mark you could get was an HD (high distinction), the next best, D (distinction), then C (credit) and P (pass). American universities had no idea what any of these letters meant.

One man, C. C. Lin, a famous mathematician at M.I.T. wrote back saying that although he didn't understand the marking, they did have a colleague working in Canberra and if I worked with him for a year and he recommended me, then he would take me. This was John Miles, and I worked with him in Canberra for a year which was arguably the worst year of my life. Canberra was just boring beyond belief, and I was the only student of John Miles. He asked me if I would like to go with him to La Jolla where he was taking up a job six months later and I agreed

I left Australia when I was twenty-one and went to southern California. The University of California at San Diego is most famous for its connection with the Scripps Institute of Oceanography. I got a PhD from there; had some wonderful mathematics teachers, including John Miles. I met Dan Mackenzie there from whom I learned about science, trying to understand the physical world. John Miles was more interested in using mathematics and not so interested in the science. For Dan mathematics is just a tool. I did have some latent curiosity about science, but Dan was so excited by it. Bob Parker, with whom he wrote his famous paper on plate tectonics, was much more interested in the mathematics than Dan, and I just found Dan's view much more interesting.

I did my PhD on flows of air over mountains and lee waves. Near the end of my time I told Miles that I could draw streamline patterns to show what the flows looked like. He thought that my estimate that it would take a week made it a waste of my time. However I did it; today nobody will remember the mathematics but the flow diagrams have been reproduced and are still quoted. It is an example of how the presentation makes an enormous difference.

---

6. Cambridge University

I then came for what I thought would be a one-year post doc to Cambridge in 1968. I got trapped in Cambridge, partly because I came to work in the Department of Applied Mathematics and Theoretical Physics which was just fabulous. It is by far the best department for my subject in the world. Even now we have more Fellows of the Royal Society from Australia than anywhere else; partly because of my head of department, George Batchelor. An Australian, he helped me make the transition from Australian/American PhD into Cambridge/England. He is a clear-sighted, shrewd, physically oriented, fluid dynamicist, who was not interested in the mathematics per se.

It took me about four years to be able to concentrate on the science and not on the mathematics. Also King's was a wonderful place where I became a Fellow, totally due to Dan Mackenzie, in 1970. There were wonderful people here then and for the first fifteen years; there is not much fun any more. I loved Edmund Leach as Provost. Gabriel Horn also taught me some science; I ran a series of talks by fellows of the College and he gave one of the very best talks I have ever heard about how to do science I was influenced by Adrian Wood as an economist and in politics; I clashed swords with Sydney Brenner but learned from him.

Ken Moody was the Director of Studies in Mathematics and he was wonderful, so sensitive and understanding; all of that, and a lovely city to live in, made me stay here. I am looking to move on to somewhere better, but unfortunately I have not found that place yet. I got to know Bernard Williams well; I thought he was wonderful at clarifying ideas suggested to him. He was also a good Provost and highly knowledgeable and cultured. I also learned quite a bit of science from Pat Bateson. Hal Dixon was inspiring for his love of King's and was also interested in science. From Dan Brown I learned about chemistry; I was Convenor of the Research Centre when we hired some chemists and Dan helped to explain to me what they were really trying to do. He was a good Fellowship Elector as he understood how to describe science to us; Martin Hyland does a totally different mathematics to me, he really is a mathematician.

---

7. Molten Magma and Mushy Layers

Outside King's the most important contact in Cambridge is Steve Sparks whom I worked with, and together we really originated the field of geological fluid mechanics. That was again due to Dan Mackenzie. On his suggestion, Steve contacted me from the Department of Earth Sciences to ask if I knew any fluid mechanics. We met and he talked about his work and I talked about meteorology and oceanography which I was working on at the time. By and large neither of us understood what the other was saying, but I could see that he was a lovely guy and was doing some interesting and stimulating science, and I could see that I could contribute something to it.

Even though I had a grant that had just started to work on an area of oceanography, I turned round and started working on geological problems. My colleagues thought this was terrible risk but I knew there was no risk at all; it was obvious that something good would happen with Steve. We did some nice work looking at how fluid molten magma behaves beneath volcanoes. In some sense we did the first fluid-mechanical investigation on how the molten rock which powers the volcano operates. What I could also see was that this was not a little area but a huge area and that there were lots of other things that could be done.

We started working together in November and Steve went away for a long Easter vacation in March; one of the last things I asked him was for another totally different problem in another area that I could look at during his absence. I thought about the problem, got some nice theory, did some experiments. It is one of the things that I am best known for - how viscous fluid spreads; Steve came back and I showed the results to him; it was clear that he was not interested and this puzzled me greatly as it was solving the exact question he had posed.

He said that was not the question he had asked and I realized that I had misunderstood him. Lord Florey, who is my real scientific hero, an Australian Nobel prize winner, once said that he would work with the devil if he had something to teach him. Peter Medawar, Florey's student, later wrote that you should only work at the bench during the week with those people you are happy to socialize with at the weekend. I was lucky; Steve is not the devil but he knows an enormous amount and had a lot to teach me, and we were friends at weekends.

After Dan Mackenzie, Steve was the greatest influence on my career, and vice-versa. I think it fair to say that the Huppert and Sparks papers are considerably better than anything either of us could do on our own. He was interested in geology but knew little mathematics, although he has an incredible insight into it. He knew what problems were important and when the solution was correct. I knew how to do laboratory experiments, which was something I learned from Stewart Turner, and together Steve and I built up this field of geological fluid mechanics.

There were a lot of Australians who came to Cambridge, partly due to the fact that the first non-royal brothers (Michell) who were fellows of the Royal Society of Australia, had a student called Cherry who came here as a Fellow of Trinity. On his return he set up the School of Mathematics in Melbourne which produced George Batchelor. He came here and set up the Department of Applied Mathematics; as a

result lots of Australians came here to do their PhDs and then stayed on. There are not many coming from Australia now

The first problem that Steve and I worked on led to the understanding that in the big magma chambers under volcanoes the motion was turbulent; before that people had thought it was rather slow laminar flow. Maybe ten years after we did this work I was on a field trip in Hawaii and we went pretty close to a volcanic crater. The leader of the field trip said the magma was in turbulent motion; I got excited and wondered how she knew this. She said that Huppert and Sparks tells us so.

I have been lucky in having some wonderful graduate students; at one stage, six in a row became research fellows of colleges; with one of them (Grae Worster) I set up a quantitative investigation into solidification, how melt turns into a solid. This is useful in order to understand how magma forms rocks, also how ice is formed from sea water. He was a very good student and produced a very nice theory for his PhD. I was feeling rather low when he left and thought I should do a whole series of experiments on the subject, which from a scientific point of view were the best that I have ever done.

The reason was that his theory and these experiments were totally different with no agreement whatsoever. You learn from an experiment like that; part of his dissertation had looked at another possible form of motion; I could see quite quickly that that little part was relevant - so-called mushy layers. Instead of it being totally solid or totally liquid there is something called a mushy layer which is interstitial liquid bathed in parts of a solid. We then wrote a nice paper in 'Nature', with a fabulous front-cover photograph which got us a lot of publicity, of how mushy layer ought to work. We were not the first to do that - Paul Roberts had written down the equation but he made it too complicated and didn't get the solutions. Grae has now developed the idea of mushy layers further; that development of mushy layers, looking at how they grow and affect the formation of steel ingots and influence casting problems, is another important piece of my work.

---

8. Carbon Sequestration

Carbon sequestration involves putting carbon dioxide into a compressed, liquid-like form, in the large porous reservoirs beneath the Earth's surface at about a kilometre. I became interested in this in a rather curious way. One day a small woman (Sarah Lyle) came to my room and told me that she was captain of the University women's rugby football club, a third-year earth scientist, and wanted to do a project on carbon sequestration with me as her supervisor.

I told her I knew nothing about the subject but she was persistent; I learned a little about it and she did some lovely experiments and I did the theory. I realized that carbon sequestration was another huge field. I have estimated that 100,000 people are working in this area - engineers, policy makers, economists etc. - but there are only two or three groups in the world working on the fluid mechanics of it. The questions are how fast does it spread, how far will it go, how risky is it, all very important problems. I was lucky enough to get a very good post doc from America, Jerome Neufeld, and with him and Sarah Lyle, and a number of others I have done a series of investigations of fluid-mechanical aspects of carbon dioxide sequestration. My earth science background was useful because I knew about the geology, my fluid-mechanical background also, and the quantitative background so that I could calculate these things.

I have done some nice laboratory experiments; one of the latest experiments that we have done suggest that once you get a crack most of the stuff will eventually leak out; there is a question of how rapidly this will happen. If it is slow it doesn't matter though you have wasted energy and cost in getting it down there. If it comes out quickly, the carbon dioxide is heavier than air and will be effectively a poisonous gas. It is an interesting area that relates policy, which I am getting more interested in, with science.

I partly became interested in policy because I was asked in 2002 to chair a Royal Society committee on bio-terrorism and I had a lot of interaction with government ministers because of that; these are huge policy matters; we are putting 28 billion tonnes of carbon dioxide into the atmosphere each year; it is not absolutely definite that it is leading to a catastrophe but there is fairly good chance that it is a big risk.

In my view you will never get people to stop using cars, planes etc., so you have to store it; that will need government regulation to store it underground, an industry to get it going, economists and the people to agree to all this, so it is a big problem. Dan Mackenzie thinks we will never get such agreement, but I am not so sure. I have been told by a number of oil companies that there is a huge amount of money to be made by sequestration but not by the first company that is involved, so each company is waiting for another to show the way.

I wrote a report for an oil company which started by saying that the carbon dioxide sequestration business is likely to become as large and as profitable as the oil industry. John Brown, the ex-head of BP says that mankind has always found its way out of difficult problems, but just how we will do it is not clear. Given the negative attitude of the public to nuclear energy which was badly handled by the government, I hope for better treatment of carbon dioxide sequestration.

On the potentials of solar energy, there is the possibility of a huge supply but the capture efficiency is very small at the moment. I believe that it will happen though I can't say directly how. That may mean that it is even more important to know how to capture the carbon dioxide that we are using at the moment because there will come a time soon when we won't be producing so much and it will be a good idea to store it. We need to store about half the output at present but the chance that it will be effective would be increased by the use of solar energy; I think that will come but the time scale is the question.

---

9. Bio-terrorism

The recommendation we made on bio-terrorism to the government as the result of the Royal Society initiative was that there should be what we called a 'one stop shop' built - one place that looked into the relevant science, that knew what was involved and would be called upon to do both the decontamination and the fighting.

The government almost immediately said no and I had a fascinating interview with Hazel Blears who was then a junior minister in the Home Office. I spent an hour and a half with her and she looked me in the eyes the whole time. She understood all I said but could not accept it politically. Roy Anderson became the chief scientific advisor to the Ministry of Defence later and he basically put the recommendation into effect. He set up a counter terrorist centre in the Ministry of Defence and that is doing more or less what we had in mind.

I have the feeling now that scientifically what we said was very sensible but I don't think that politically we were as astute as we might have been. Setting up a 'one stop shop' was definitely the right thing to do but the Labour Government didn't want to do it so you could say that it wasn't a sensible thing to suggest. I once went on a course on entrepreneurial skills for scientists and engineers and learnt that the style one should present to a CEO was the style that he was used to. We did not couch our suggestion to the Labour Party in such a way that they might have accepted it. That is when I became more interested in policy.

Now I am more senior and have learnt how the game works. I had a meeting a year ago with the 'Mr Fixit' of Australia, the Chancellor of the University of New South Wales, David Gonski. Somehow we got onto the subject of what we wanted in the world. For him, it was to make a difference, which I thought was a good answer. Being interested in policy is about that; I can write papers with hundreds of citations, but will they make a difference? Not at all; maybe in policy matters you can have an influence, but it is much harder.

---

10. Reflections

The College System

On the college system and creativity, I have had enjoyable conversations but I can't say that my research was helped. There are not many people in King's who do science the same way as I do apart from Dan Mackenzie. However, I made friends here and got to know England. One of the high points for me was the non-resident's dinner when in my twenties I would find myself sitting next to an older man who would explain what England was like from his point of view. To be able to say I was a Fellow of King's gave an extra status. I also enjoyed the Chapel music and the building itself; Donald Parry was Vice-Provost when I was made a Fellow; he was enormously kind and welcoming, also to my wife.

Creativity

I think that you are more likely to be creative when you are relaxed, but I have had ideas in all sorts of situations - in keep-fit classes, the shower, with the tension of doing an experiment. The other day in relation to sequestration I was thinking about the efficiency of storage, and while in the shower thought of a wonderful experiment which I did with a post doc this morning. I enjoy working quietly in my office but I'm not good at fitting things in short time spans. I lecture a reasonable amount which I enjoy, except for the time that it takes. When I first came here I taught first-year undergraduates which I enjoyed enormously. I think I am good at enthusing people who are interested. I have taught final year graduate students. I always supervise the courses I teach in King's, and enjoy it. Some of my good friends have been students that I have supervised, although they still find it difficult to call me Herbert.

Politics

I have not been interested in politics as such as it is so time-consuming. My son, Julian, has been a county councillor for two terms so I learn enough about Lib-Dem politics through him. *(Editor's note: Julian Huppert later became MP for Cambridge).* I am not interested in large-scale university politics, but am interested in how you get departments going. Ron Oxburgh is fabulous at getting people to do what he wants and I wish I had his skills. I like guiding students along so that they feel confident in their work. I am the director of the Institute of Theoretical Geophysics which has about thirty people and seems to be a happy place. An important part of it is that we meet socially as well as scientifically so people talk together.

Advice to a Young Scientist

My advice to a young scientist would be to be in the best environment that you can, find the best supervisor that you can, and do something different. My own experience of the importance of environment was with Dan, where everything was so easy. I have sometimes been in other places for a month or so by myself, but have never accomplished much. On supervisors, there is a huge correlation between

individuals who have won Nobel prizes or become Fellows of the Royal Society and their supervisors. I was asked to name the ten most influential scientists in my career and they are all FRS or the American equivalent. To do important problems is clearly worthwhile, problems that other people will be interested in and have some point to them.

Felicia

Felicia, my wife, is Professor of Psychology in the Department of Psychiatry; she is interested at present in wellbeing and happiness, also a matter of great policy importance. I have enjoyed getting to know some of her connections. In Britain she has been asked to speak to the Cabinet Office a number of times; in America she has been asked to arrange conferences with Marty Seligman the originator of 'positive psychology'. He has worked for the American government on bioterrorism but his work is totally confidential. I have made the point that my work is always open. I have talked with him about it but he can say very little. People have asked me how I feel having a wife who is now more famous than I am, but it doesn't worry me at all. She doesn't enjoy Cambridge nearly as much as I do, but she has been a wonderful mother to our children, and has worked hard.
