Clip: GOWING MARGARET_MARGARET GOWING WITH CH

Name: GOWING MARGARET_MARGARET GOWING WITH CHARLES WEBSTER OXFORD _LOBAND DUB USE FOR DUPLICATION_BOX4_cust ref_MID19725993

S1 **00:01:38:01**

Charles says, almost a complete generation between us. I was born in 1921. And you were born in 1936. So that. Let's talk for a few moments about our family background. I'll start with mine. My parents were downwardly mobile. My grandparents on one side had been a shopkeeper and on the other had been rather middle class, intellectual, middle class. But we lived in some poverty in North Kensington, and I went to Portobello Road School at the age of four, and I always remember being in a class of 60 with a very mixed social gathering around me from the much slum bits of North Kensington. Where did you begin and go to school to begin with?

S2 **00:02:33:07**

I think I was arguably even more downwardly social and socially mobile in the sense that I came from a middle class Austrian family, of course, caught up in the political difficulties of the 1930 and therefore my parents were exiled. I was actually born in in Britain, but of course, quite quickly my mother was interned and so I was very luckily transferred to a working class family. And I moved from the countryside into inner city Nottingham where I had a very interesting background, but probably went to a school very like yours, the sort of old, an old bored school, very under provided. And if anything, were the atmosphere more of a prison than a school?

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S1 **00:03:27:11**

I couldn't remember Portobello Road School so well. But one of the things I remember most clearly on the general question, which is interested both of us at an academic level, the question of educational opportunity. I remember that of my class of 60, I think four people went on to post age 14 education. It was the aim of the teachers in these schools to get their children to the grammar school. But also there was the additional prize in London of getting children to Christ Hospital, and I was put in for the Christ Hospital Scholarship, which I got at the age of 11. I was, as it were, wrenched from my home and went to this very strict, old fashioned boarding school, which, interestingly enough, was on the lines of comprehensive school because in fact, their intake came from many different classes. I stayed there till I was 16 when I won a scholarship to the London School of Economics. I didn't enjoy the boarding school, but I'm eternally grateful to the headmistress of the school because my father wanted me to become a clerk in the civil service, which was the height of most people's ambitions in those days. And the headmistress insisted that I should go to a university and having taken the scholarship and got a scholarship, I therefore went to LSC in 1938. How did you go on from your school?

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S2 **00:04:49:15**

I think that my experience in the sense was similar, but I didn't detect in my primary school experience any expectation that there would be a transfer of more than a very small number to grammar school education, which was the only possibility in our area. In fact, I remember the 11 plus vividly. It was the first examination of any kind I'd ever done. And we were herded into this room and of course there was the inevitable result that very few of us actually passed the 11 plus, and I think it probably was 2 or 3. And the majority went on to a secondary modern school and I was one of that group. But in my case, the transfer to a more advanced stage of education came through the opportunity to take the 13 plus, as it was called, when a very small number of children were given an additional chance to take an additional examination. And then that did give me the chance to transfer to a grammar school for a short length of time. And I left grammar school at 15, equipped with some O-levels and went to work in a in the for the Boots Pure Drug company as a laboratory assistant.

S1 **00:06:13:14**

Well when I left school at 16, left Christ Hospital at 16. As I say, I had this scholarship to the London School of Economics, but in fact I had not done any economics. Of course, at school I didn't like science and I didn't like history. So it's a really rather peculiar that I've ended up as a professor of the history of science, and I had dropped all of them, but I was interested in the wider. World at large and thought that LSC was the place that would give me what I was looking for. I went there, of course, in 1938, just at the time of the Munich crisis. So all the forebodings which in fact my family had had about LSC being a hotbed of Reds and all the rest of it, and was I going to get sucked into a kind of very peculiar political atmosphere were to some extent justified? Because I mean, we were there were marches and, and a lot of time was spent in political activity. But I do remember it also academically this first year, because some everybody at LSC, of course, did the same intermediate BSC second degree, which included economics, British Constitution and of course, economic history. So this was really my first

introduction to history, which, as I say, I had found extremely boring at school. It seemed to be a succession of kings and kind of little genealogical tables on blackboards and so forth. And the intermediate BSC lectures were given by Eileen Power, whom I can see so vividly even now. She was a splendid lecturer. She was also very handsome. It's also a great comfort to me to recall that she lectured from a script, which I myself do and some people think is the recipe for a bad lecture. But I remember in particular one lecture she used to give on the old poor law, and it ended up with her looking over her spectacles and saying, Hark, hark, the beggar has come to town. But if I could go forward to our evacuation, to Cambridge. Lucy went to Cambridge in 1940, and on the strength of Eileen Parr's lectures, I had decided to specialise in economic history and at LCC, the economic history was extraordinarily good. People came down from London. Of course, some of them were working in offices, but came down and did some lecturing. But the history, the people who were particularly important as teachers were Tawney, who said, Come down again. I can see him. It's wonderful, stormy, ancient, rough tweed suit, and his glasses pushed up over his forehead and his his white hair. And I can remember his voice still. And of course, he was wonderful as a lecturer and also as an example of a human being, because I think he was perhaps one of the most saintly people that have been in the academic profession. Probably. Can I go back and ask you how you went on from your school, your grammar school?

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S2 **00:09:20:14**

Yes, I think I think the thing that I'd like to pick up perhaps is the sort of historical content really, because like you eventually I became a historian and had an instinct for it at a relatively early age, but of course it didn't come from school. I can't remember anything about history at school. I think I did almost no history at school. The things I remember about school science and of course I then became a laboratory technician. So again, working in the evening for for part time qualifications at the Nottingham Technical College entirely in science. But of course my sort of intellectual environment as a, as a as a, as a, as an adolescent was really the among the working men who who were in the association with my guardian. And of course they were active socialists and they had a strong view of history. And it was that kind of thing which I do deeply remember. And I think to the degree that I have any sort of intellectual obligations they are to that particular group of self-educated men, they were really quite remarkable, particularly Tom Mosley, the erm the leader of the Nottingham Secularists, who was not only an active writer but also a remarkable orator. Every Sunday evening we used to go to the Nottingham Co-operative Hall for a socialist meeting and from the Co-operative Hall we used to process down to the market square where Tom Mosley would harangue the crowds and it was a very impressive experience. So I picked up a great an interest in history and already read a great deal before I went to university.

S1 **00:11:09:03**

I always remember asking you once, Charles, I said, How do you know so much history? And you said you were reading Morley's Life of Gladstone in the public library when you were 11. I was enormously impressed, yes. As I as somebody who is doing history, would never have dreamt of reading more all his life.

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S2 **00:11:23:12**

Yes, I just read anything that came to hand. Really. I had no idea. Sort of no idea really, that sort of books of being more or less advanced. I remember one particular. Precious set of books which you had at home with the left book Club editions. I DIDN'trillionEALIZE, of course, at the time, how useful the acquaintance with those would be in later life. But I found that from time to time I've picked up bits of the left Book Club experience and exploited it. And as I was growing up, of course it was the time of the first Labour government after the war and it was a time among socialists of great idealism and expectations. And I've come back subsequently to study that period as a historian. And I think again, I benefited enormously by the sort of educational experiences of that time in the informal context.

S1 **00:12:25:04**

Well, I think that helps to answer a question I've often asked you, Charles. Which earth do you know so much when I hear about your omnivorous reading over such a very wide range of subject matter? I understand much better how, as a historian, you have covered such a remarkable range in both time and subject matter. After all, you wrote a superb book on the 17th century, and you have just been writing the history of the first ten years of the National Health Service. So can I go back and pick up my thread from when I left LSC in 1941? At that stage, most of us who were not going into the services are you most of the women anyway. We went into the civil service and I went into the Board of Trade as an assistant principal. This was an extraordinary experience. I think people perhaps don't realize what a wonderful intellectual environment the wartime civil service was because, of course, there were an enormous number of dons of various kinds who were in there temporarily and certainly in the Board of Trade. There was a gathering of economists and historians and sociologists and people who were all kinds of recondite archaeologists and so forth, and I learnt an enormous amount. I mean, one of the great things about being evacuated to Cambridge and one of the things I remember very vividly is going in November 1939 to Keynes's great lecture on how to pay for

the war. And this was my introduction to Keynesian economics. And suddenly economics made sense. So now I think this brings us brings me to 1945 when I, I realized I think one of the phenomena of those days, social phenomena of those days, which most people find it almost impossible to believe, is that there was a marriage bar in the public services. And I had got married on D-Day plus one. My husband was in the Navy, and it was assumed that at the end of the war, the marriage bar, which had been lifted during the war, would come back again. So I assumed I would not be allowed to go on or apply for the post-war civil service. And at that stage I heard of the historical section of the Cabinet Office where an extraordinary thing had happened in the middle of the war when manpower was very scarce. The Secretary of the Cabinet, Edward Bridges, had decided that the economic and social aspects of the war should be recorded for posterity and recorded not in a simplistic way, but by professional historians. And he himself had recruited to do this. Keith Hancock, who was then professor of history of Birmingham but was soon to become a professor of economic history at Oxford. And here is this group of historians who were given access to top secret documents coming straight off the secret printing presses. And I think this was a vote of confidence in the importance of history, which is really very heartwarming. One of the historians that Keith Hancock recruited was Richard Titmuss to write Problems of social policy. I mentioned this here and now because some in many ways you and your work seem to me more in line with Titmuss in his work than the work of any other historian I can think of.

S2 **00:15:57:11**
I think modesty prevents you from saying that you're the co-author of one of the great classic wartime histories, the The Wartime Economy, the one that you did jointly with Hancock, which has been reprinted.

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S1 **00:16:12:10**

One of the things that I I'm glad I mean, one reason why I'm glad that they're there now is, for example, with Crawley, Barnett's new book about the audit of war, because I think that the material which is in the war history, does a great deal to blow up the myth, which I think he has perpetrated in his audit of war, about the about the the war. Economy the way it was run, the fact it was a disastrous failure and so forth. Now, I think I think it was, but I think it was partly the confidence and, as I say, the ability of bridges to persuade Churchill. And it was done at that level that history was an important part of the war effort at a time when there was a great demand for historians in other places. But perhaps to continue this, as I say, I went into the war histories in 1945, and I thought after time that perhaps some my experience and indeed my interest would be well served by doing something else. But again, it was it was the marriage bar that came into it because I all historians were an established civil servants. We were not on his staff, so there was no pension. And my husband was a professional musician earning rather little. So I thought, I can't stay in a non established job. I had two sons by that time and at this stage in 19 1959, the Atomic Energy Authority also very praised, worthily advertised for a historian and archivist. They wanted somebody to get their records in order and they wanted a history written. So I transferred to the Atomic Energy Authority in 1959 for the Cabinet Office.

S2 **00:18:01:14**

I ought perhaps to bring my sort of side of the story a little further forward at this point. And it isn't necessary to dwell on this at length, but, um, I went to University College London again as a as a science student and of course for three years history impinged very little on my activities, but I am struck again how informally there was a great deal of, of historical or historic or semi historical influence in the in the environment. One of the my science lecturers, Peter Bell, was himself a keen amateur historian and introduced a great deal of historical content into into his lectures in the field of botany. And there were some formidable left wing intellectuals still at University College at

that time, led by JBS, JBS Haldane. And I think it was one of the few places in Higher Education University College where there was a noticeable Marxist element in the in the academic staff. One didn't realize how unusual and perhaps even unique it was at the time, but it was certainly helpful for keeping the spirits up. I did, in fact, hit upon the idea of of taking up the history of science at that time. And I think, as I said to you before, as an undergraduate, I and a friend went to the Department of the History of Science to see if there were any undergraduate lectures in the subject. And we got a pretty dusty answer from the professor there and told us to come back when we had our first as graduates and that we could then consider associating ourselves with the department. So the opportunity to take up the subject in any sort of serious sense didn't didn't offer itself then. But I made a decision on graduating in 1958 to leave scientific work, and I left scientific research and went to teacher training in Sheffield, where I knew that the professor, Professor Armitage, was interested in the history of science. And I thought that this would give me an opportunity to look at historical studies a little more seriously and consider whether there really would be an opening in the field of the history of science. And I really was greatly indebted to Professor Armitage for all the encouragement that he gave me in the course of that one year teacher training which I undertook in Sheffield. And of course, I decided to stay in Sheffield in teaching after that, partly with a view to having access to the university library and continuing to get some kind of help from from the Education Department in this this this particular area. But your work in the Atomic Energy Authority.

S3 **00:21:04:23**
Yes.

S2 **00:21:05:21**
Official historian.

S1 **00:21:06:21**
I became their official historian. And I didn't know the difference then between an atom and a nucleus or or anything about

science. I was totally unscientific. Looking back, I think I must have been crazy. But the thing that made it possible was that the scientists were so extraordinary. Nice because inevitably I was mainly concerned in the beginning with how the atomic bomb became came to be made because this was the beginning of the project and it was one of these extraordinary. Coincidences of history that the outbreak of the Second World War came in the very year that atomic fission was discovered. And it was in fact two refugee scientists in Britain, Rudolf Pyles and Otto Frisch, wrote an extraordinary memorandum in 1940 which showed how and why an atomic bomb was possible. And it was this, in fact, which got the American atomic project off the ground. And as I say, the scientists and certainly Pyle's, for example, were enormously helpful. They thought history was important. They didn't say, Why are you wasting our time and yours? And they were great allies. The papers were difficult to find because I remember finding a copy of the Palfrey memorandum, which everybody said had disappeared at the bottom of an old cornflake box. And, of course, the interest to me was that it mixed science with politics because while the scientists were doing all the discovering, there were great political negotiations going on at the president, prime minister level, so that it was the kind of history that I like, where everything is mixed up and life isn't separated out into self-contained compartments. But after my first atomic energy book came out in 64, I thought, well, perhaps it would be a good thing to go and teach in a university with this experience and so forth and the university. Of course, it's when the new universities were being founded and the University of Kent took me as a reader in contemporary history, and it was my first experience of university teaching, of course. And I must say that I loathed it. I loathed my time at Kent. I found the whole new university policy after I had been there, very doubtful, very dubious, simply, if anything, in terms of public expenditure, because when my children were at primary school, I got very much involved in the Association of the Advancement of State Education, in fact, was one of the founders of it. And when I thought of the difficulty of getting money for slum lavatories in slum primary schools to go and see the concrete never setting on

the hard tennis courts, the sports palace, the colleges, each with their own, each with their own catering arrangements. So that in fact it seemed to be the conversation largely in the university centred around the catering deficit for years and years. But it all seemed to me a wrong development for the universities at that time. I wasn't very happy. I could write, I could teach the kind of courses I wanted to, which was Charing, but I don't know quite what I should have done except that in 1972 Oxford advertised the chair and the history of science, the new chair in the history of science. It would not have occurred to me to apply for it, but piles the scientist wrote to me and said he did hope I'd apply for it. And I did, and to my absolute amazement, got it. It was partly because I think that I thought I was not really in any way a runner for it. But at the interview and I'm usually very bad at interviews, I was really quite light hearted so that this was, to me an enormous surprise and of course very distasteful to the academic history of science professionally from complained about my appointment. And indeed, one of the first things I did after being appointed before I arrived at Oxford was to sit on the selection committee for the reader in the history of medicine to which you were appointed.

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S2 **00:25:12:20**

Yes, I think it's one of these few things that puts Oxford in a in a good light the willingness to bring in outsiders and pioneer new approaches to subjects. I think that we were lucky at that time that Alan Bullock was the vice chancellor, and there was among Bullock and his colleagues in the history faculty, Trevor Oprah and Christopher Hill agreeing. I think one of the few times a feeling that the history of science in Oxford just hadn't developed and that they needed to bring someone in who adopted a completely new, new approach to it, a genuinely historical approach. In the meantime, owing to the same expansion of the universities, I was able, after pursuing research part time as a schoolmaster, to move to lead university. And I think I was lucky. I like Leeds University, like Sheffield University, I like Leeds University and like you, I think that the old civic universities were great institutions and they were very much maligned at the time and the development of the universities was a disaster. And Leeds had a great tradition and I was lucky to be in a department of philosophy. It so happens where the sort of intellectual outlook that we subscribe to what? Was actively cultivated and it was possible at that time to build up a very rapidly a new research group in the field of the history of science. And it was that which led me to be able to come to Oxford in in 69. It so happens as a research fellow and then ultimately, as you mention, to take up the readership in 72 with the same the same objections registered by the professionals in the history of science. And that gave me the opportunity to establish a research unit in the in the history of medicine. The history of medicine hardly existed when I began in the field, and the first academic group in the subject was established in 1967 in London. My group, it so happens, was established in a history faculty in Oxford, and we were determined to pursue the history of medicine in a rigorously historical way, which meant in the sort of way that, say, the Arnold School would approve of or compatible with the English School of Social History.

S1 **00:27:47:22**

I think that the the in our time at Oxford, the history of science

as a subject has changed enormously. I think you and I have probably made some contribution to it. But of course there are other people. I mean, I was appalled when I became a professor of the history of science, as I say, feeling how small my qualifications for the post were. But after all, I had been writing about atomic weapons and the mixture of science and politics. And of course, when I came into it, the textbooks were written by people like Sarton Quarry, who believed that science was simply the epitome of the human soul at its very best and so forth. And they wrote the most awful trash about science. And indeed, some of the younger people did. I remember the book that came out just as I became a professor by Jerry Ravitch on social, on on the science. And it's the history of I can't remember what it was called now science and its social responsibilities or something, which was meant to be historical. And really saying that before Second World War science was pure and non industrialised and so forth, which of course I mean is absolutely absurd. I mean, when you think that Kelvin owns 70 patents, it's never been true. It wasn't true in your 17th century even, and much less true in the 19th and 20th century anyway. And I remember, for example, reading the proceedings of the great meeting that there had been in the United States in the mid 1960s of the International Union for the History of Science and people going on talking about, you know, science was a commune of workers, you know, not interested in money or power and so forth, and never mentioning the atomic bomb. And here you had so very recently when the conference was held, you had this gathering in North America of the greatest galaxy of physicists, Nobel Prize winners you'd ever heard of, all concentrating on making atomic bombs. So the whole thing seemed to me completely removed from the real life which I had experienced in the kind of work I was. I was engaged on the change in the profession, which I think we've been part of, has been enormous. I think that the books that are being written, the the attitude to the subject as a whole is quite different. Um, and I think, for example, you see one of the great things that's happened is the separation of history from philosophy of science, because I think this was most unfortunate because it fastened on the subject to a kind of pre predisposed

kind of set of theories and so forth. And this applied not only, of course, to the extraordinary people like Sarton inquiry who just said science is pure and beautiful and so forth, but the people who in other respects admire somebody like Bernard, for example, the Marxist historians, always were concerned to link science and politics, which is really the nub of the thing. But of course, again, they did it in the worst kind of Marxist way that is putting a preconceived set of ideas, not like historians work, which is, as it were, moving forward, taking a range of subject matter and just looking at the evidence and forming your conclusions afterwards. I mean, Bernard himself, of course, could write some wonderful books. I think his science mean one of the books he wrote about science and technology in 19th 19th century was a superbly by our standards book. But then he wrote this four volume book, Science in History, which is bunk, which is simply a cliche after cliche.

S2 **00:31:30:22**
Perhaps that's a good note to end on that, that in fact, the history of science has managed. To shake itself free of scientific antiquarian ism of the philosophy of science. I always do agree with you that the relationship the two between the two was fatal. That department at University College was a department of the history and philosophy of science. I think it was a sterile hybrid and that that once this emancipation occurred, then it did open the way to a much more sophisticated view of the subject, and one that I think in due course will have a considerable impact among historians in general. And the best of the work coming out at the moment is as good as any research in the field of history.

S4 **00:33:49:24**
There's a history from his particular time. post-Second World War we had teaching machines. The idea that there was an organizational format whereby you could proceed with learning in discrete steps with a sequential disclosure of information. The disclosure of information was dependent upon systematic self checking, and it was constrained by the capacity of the student for self instruction. This work was greatly enhanced by the

Harvard psychologist Skinner, who developed a theories and demonstrated that small and easily mastered steps were particularly efficacious in promoting learning. We saw the beginnings of Go or not go systems for both sequential and for branching systems using teaching machines. And the serial ones were perfectly straightforward. You went forward or you did not go forward in the branching systems, the situation was more complex. We had the idea that a student takes a step and the machine tells the student whether that step is correct. It refers the student. If he is wrong to something else, he then has to try again and so on and so forth. These systems were well known and it's likely that the chain of events from rats through programmed learning systems and teaching machines reached a cul de sac. And the reason of the cul de sac is, of course, that the teaching machine was doomed and in the sense the teaching machine was doomed because of the appearance of the computer. Here was a device that was far superior. I making a little bit of humor out of it all, thought that the idea of the chain of events from vodka through to program learning with a resourceful personal computer reaching a cul de sac was likely to be a modern analogy to the technical cultural impasse that was reached by the establishment of the optical telegraph and. The optical telegraph. I hope you can see this of chap was first demonstrated for effective purposes in 1794. It's interesting that chap was one person who was attempting the problem of transmitting electrical impulses through wires, but he couldn't do it because of the prevailing lack of knowledge of the principles of electricity at the time. And nevertheless, just about the time when the electricity was about to break into the world, we had the fastest system yet of transmission of information by optical telegraph. Two examples are shown here. The lower picture is of the famous Parry to Lee line of 1794. The the news was telegraphed from Lille to Paris in August 1794, which announced the captures of Conde Gore and Le Canio from the Austrians by the French Revolutionary Army. I don't know the distance, but I would think it's probably 160 or 180km. And the news came back within an hour of occupancy by the Army. Now, this, of course, caused this particular style of telegraph system to be used much

more widely, and not least, of course, for military purposes. The upper picture shows the mobile Chapel Telegraph, which was in use by Napoleon's army in Russia in 1812. If we want to probe around in the ironies of history, then we might note that the last major large scale chapel telegraph, which was 220 stations all the way from Warsaw to Moscow, was completed two years after the first use of copper wire and the code key in the Wheatstone Electric Telegraph in 1837 1837 happens also to be the year of formation of the Royal Polytechnic Institution. I sit today in a successor institution of that particular institution. Now, whether or not the Royal Polytechnic Institution was at the end of a technical cultural impasse is another question. And maybe it stood the end of one or the beginning of another.

S2 **00:39:05:19**
Also.

S4 **00:39:07:14**
Aside from developments of this particular source in the early part of the last century, 200 years ago, we have coming up closer to the modern day, very considerable TV experiments in universities. And I want where your where were you with the problem of difficulties of this particular medium in the universities? Suffices for me to say that in all probability two three, maybe four decades of experimenting have had relatively disappointing results and the use has not been particularly widespread. Well, no. If we have. This particular background, this particular sort of background. What are we to make of the television media and associated communication developments today? We have a history we have in this country. For example, the Open University, founded in 1971, it was thought of as being a University of the air. It had distinctly political background in the sense that a particular political party advocated it and instituted it. It has faculties which are not particularly different from those of ordinary universities. It conducts certain cross-disciplinary activities such as Third World development, women's studies and the like. It runs continuation courses, but it's not really all that media dependent. You have to have

correspondence. You have to have core material in text published by the university. You have to have experimental kits. If you're doing science, you have to have localized study groups with tutors, and you have to have obligatory residential courses during the summer. So we might be justified in concluding that the Open University was rather an abundant part of the British University system rather than the precursor of any ether university. And the nearest we get to the concept of an ether university is the National Technological University in the United States. But even that has certain limitations and nevertheless they've made great technical progress. They use transmission time for formal course purposes, which in American terms are for credit courses, mainly at the master's degree level, mainly during the daytime hours. They use the night hours for continuation courses and they have support from some 40 universities who supply several hundred normal curriculum courses for master's degrees for broadcast. You can register with these with either the parent university or with the National Technological University. It all depends on the particular arrangements that have been made. Some 400 sites are available for the reception of the programmes from an impressive list of manufacturing and service companies, national laboratories and governmental institutions who also provide other supportive participation. They have experts on hand so that the students at any particular site can in fact have an interpreter, an interlocutor, if you like. This is a form of interactivity which is new and moreover appropriate to this particular type of learning transmission. And the latest move of the NTU is to use the Pan Am Satt set of satellites for the transmission of their courses around the world. Professor Kane and I recently visited them. We were of the view that some of their courses were not out of date. I think that would be a wrong criticism to make, but they they were in formats or appear to be in formats which were very characteristic of the situation. Some years ago, they were not using contemporary ideas, particularly not using the build up of short courses into longer courses. Also of some possible interest is again an American case is the science and engineering television network which isn't in existence yet, but is likely to be. It does not profess to be engaging in education

as such, although it does permit of the possibility. What is of importance is that it's likely to be sustained by advertising, particularly advertising by companies and organisations which are dependent upon apparatus and scientific equipment, engineering and like. And there is a possibility that Seaton may appear on the scene with education courses. In Europe, we have two organizations, Europe and Eurostep. It is thanks to Eurostep that I am on the ether today. At the moment these organizations are in financial difficulty and they're worrying about the ways in which their income and their support can be derived in the future. There are other cases, but it doesn't amount to a very great deal in terms of educational output, except in the case of the National Technological University. This is as yet the only organization which has actually started to use the ether in some systematic way quite regularly for the propagation of high grade courses in a well engineered fashion. Now, we have been through a little bit of history. Let us have a look at another aspect. The first official message by the telephone semaphore on the 15th of August 1794 corresponded to a bit rate of about 0.5 bits per second. Alexander Graham Bell, then a professor of vocal physiology at Boston University, put out his famous patent, of course, and he transmitted words on the 10th of March 1876, 100 years later. This is an increase of the bitrate of approximately 100 times in a century. I have slightly arbitrarily given the transmission capability in computer networks as, say, ten to the seventh bits per second. It is, in reality somewhat greater than that. You will notice the corresponding figure that over the hundred years from Alexander Graham Bell's transmission of words for the first time we have approximately a 200,000 times improvement in the rate at which information is transmitted. Now, this is very significant. We. We have, you will note now started to speak not just about media transmission in the sense of using satellite broadcasts. We have started to talk about computer networks and indeed, these are the terms technically in which we must now conduct the discussion. We are speaking of the whole means of transmission of technical information, which bring to bear all these huge resources of speed and saving of time, and one would hope, increased facility,

which I mentioned at the beginning. Now, there are many ironies in what has happened. I once showed this particular illustration in one of the earlier. Telecasts from here. I started with the Times newspaper, which was published some years before the French Revolution, and we have a mark for the chap Semaphore in 1794. We proceed with 19th century transport systems to the invention of the bicycle and the invention of the electric lamp in the decade 1872, 1880 and the coming of street lighting. We have Alexander Graham Bell transmitting his speech in 1876. We proceed into the 20th century. We have the first commercial TV broadcast around the middle of the 1930s decade. It's very interesting that. The first transatlantic telephone cable, however, was not in fact laid until 1956. This is not the first long distance telephone cable that was in 1900. But even that is an irony, because one year after the first telephone cable was laid, the first long distance telephone cable was laid, Marconi transmitted a message by radio across the Atlantic. Well, we have to return to this particular case, the transatlantic telephone cable, relatively recently, less than 40 years ago. But you notice that one year after that was done, the Sputnik was up. And of course, after the Sputnik, we have other developments which I will not weary you with, but illustrated by the bottom part of my cartoon here. And may I draw your attention to the most significant event which indeed this course of transmissions are dedicated to, which is the broadband revolution. Now, this has made an enormous amount of difference to start with, government after government, as long as television stations were restricted to ground based stations. FM As long as telephone systems were based mainly on wires, copper wires spread around all over the place, with centralized switching governments engaged in various sorts of regulation, control and censorship. So the first thing that we notice with the new technological changes is, of course that governments no longer have quite the same powers. It's very difficult if somebody is broadcasting using a satellite to interfere with the particular transmission. And this is one item which is made entirely different situation. And furthermore, it is accompanied, of course, with the broadband revolution. We don't any longer have to argue about the allocation on some sort of restricted and

negotiable basis, particular frequencies for particular purposes that are very limited in their availability. We now have with the compression techniques an immense spectrum effectively available to us.

S5 **00:52:45:12**
Moreover.

Clip: GOWING MARGARET_MARGARET GOWING WITH CH

S4 **00:52:47:08**

This itself has already started to produce structural change. We know about it from the newspapers. $1 billion deals are cones of cable companies, telephone companies and entertainment companies and so on, all buying into each other. And this then associated with the fact that the the revolution in broadband working has come. Now, should I close by saying something about the university roles? Because we've got. A problem. The problem that I spent possibly a little too long speaking about at the beginning, we have to decide quite quickly how universities can in fact, contribute to this, because it could be that the availability of transmission capability is going to reduce universities any way to being something quite different from what they have been. They were places to which people went, places with walls and where people sat in lecture halls and they listen to professors and universities are likely progressively to become and quicker rather than slower sources. The source centres, if you wish, from which cleverly arranged package material is available for widespread propagation. And we also have the fact that networking is with us. We have necessarily to look into the way in which Harvard University, for example, has started to provide itself with an information highway. There are two ports in each room from this information. Highway one is for telephone and the other is for PC. And the person in the room has the PC and needs a license in the form of an Ethernet smart card. And this is his access to a vast amount of organized teaching material which in larger and larger measure will become interactive. And so I close. May I may I urge that there be very careful consideration and quickly of the ways in which universities can step into this situation. The Pan Am sat, if I may quote it once again, is to be used by the NTU and launch Windows defined for May 1994 for the Pacific November December 1994 for the Atlantic and February April 1995 for the Indian Oceans. And that those particular broadcasts from the NTU will literally be available across the world. Moreover, the reason a reasonable load factor will in fact reduce the cost of transmission to a few tens of dollars per hour. So I close on an echo of a famous advertisement of yester year. Thank you.

S6 **00:56:25:21**
All right. Well, thank you very much, Colin. We do only have about two minutes left. If I could quickly ask colleagues in Saint Petersburg Alexander, were you able to receive all of that transmission?

S7 **00:56:38:08**
First of all, I would like to thank you very much, Professor Kane, for a very brilliant and enlightening lecture, which is very close to the subject. And we've heard you. Very good.

S6 **00:56:49:18**
Okay. Well, thank you very much. We only have just a very brief moment to go back through. Conrad, Any quick questions in Warsaw?

S7 **00:56:57:12**
I'm sorry. This is Conrad from Warsaw. Yes.

S6 **00:57:02:23**
Speak to me.

S7 **00:57:04:23**
The first question is about the meaning of the word diversity. We were not able to find in our dictionary. We are in this, but not very well. And we have also some remarks. So, in my opinion, well.

S4 **00:57:20:12**
I can solve the diversity problem very quickly. It's since the end of the word university and it's half word, which I have coined for the purpose of these transmissions.

S7 **00:57:33:06**
We understood in such a way this.

Clip: GOWING MARGARET_MARGARET GOWING WITH CH

S6 **00:57:35:21**

Right. Okay. Conrad, we only have about one minute. Could I just quickly go to Slovenia? I'm afraid we'll have to take your question after the airtime. Slovenia, are we speaking to Tomasz or her or Urban.

S7 **00:57:51:04**

Could phone are and Marian are still here. So we would like to thank you for the very good lecture. We were able to receive everything of it.

S6 **00:58:03:04**

Okay. And so how did you like this transmission of the communications? Did that work? Okay.

S8 **00:58:11:00**

Good afternoon, Professor Kane. Yes. I'm sorry for interrupting, but I've just been told that you have an extra 15 minutes on the satellite, but. Oh.

S6 **00:58:18:09**

Well, we don't know what to do with it, so thank you. Anyway, we'll let you know.

S8 **00:58:22:00**

So we did get through to that number for you.

Clip: GOWING MARGARET_MARGARET GOWING WITH CH

S6 **00:58:24:19**

We are now closing down our program. Michelle, thank you very much. Anyway, we would like to thank Colin for this trio of lectures, which is really broadened our perspectives about this whole business of universities and what the future might hold for us. So I'd like to thank our colleagues in particular for coming online and helping us, and we'll obviously want to be following up to find out the various problems in viewing these experiments, which we did at the beginning of the program, and to see if we can actually reduce these sorts of delays and move towards a more productive version. And as usual, the problem is the telephone system. So again, thank you very much, everyone. Goodbye from the University of Westminster.

S9 **00:59:14:04**

Be my girl.

UU **00:59:22:00**

The. Can't you be my. When you turn. And walked away. And so when I want to say.

S9 **00:59:38:10**

Come on, baby, give me your. Want to know if you'll be my girl.

UU **00:59:49:01**

Hey, baby, I've.