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Niels Bohr - A survey of some of his contributions  
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**OPEN WORLD - A VISION REVISITED**

by

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(The views expressed by the author do not necessarily  
reflect the standpoint of Unesco.)

I appreciate the opportunity to take part in this meeting organized to pay tribute to the memory of Niels Bohr. At the beginning, I would like to mention that I come from an Institute whose founder, Homi Bhabha, was for some time a member of the international group which was attracted to Bohr's Institute at Copenhagen, and was influenced by Bohr.

My remarks will relate to Bohr's vision of an OPEN WORLD - in today's context.

Niels Bohr's thoughts were centred on the problems and prospects raised by the release of atomic energy more than on anything else, during the last twenty years of his life.<sup>1/</sup> He gave an account of his views and his hopes, and also of the efforts he had made to create an understanding of these views and to turn developments in the direction he hoped for, in his Open Letter to the United Nations,<sup>2/</sup> in June 1950. He also dwelt on these issues in his Evening Address<sup>3/</sup> to the First International Conference on the Peaceful Uses of Atomic Energy in Geneva in 1955, and in his letter<sup>4/</sup> to Dag Hammarskjold, Secretary General of the United Nations, in November 1956.

When he wrote the Open Letter to the United Nations, Bohr's heroic efforts in the direction of an international control of atomic weapons had failed; and in a situation characterized by "deepening cleavage between nations and ... spreading anxiety of the future", it appeared to him that "the turning of the trend of events requires that a great issue be raised, suited to invoke the highest aspirations of mankind," and that "the stand for an open world, with unhampered opportunities for common enlightenment and mutual understanding, must form the background for such an issue".<sup>2/</sup> (emphasis added)

Bohr's vision of an open world remains unfulfilled. In fact, one has been continuously receding from it, and mankind has been living under the perpetual threat of a nuclear holocaust. The threat is so big that it is difficult to comprehend, and so it tends to get ignored or just wished away. In the meantime, there also are increasing impediments to meaningful international cooperation in science and technology. Bohr had dreamt that the fraternity of scientists such as the one he created in Copenhagen would play an important role in the realization of an open world. It may therefore be appropriate on this occasion to remind ourselves of Bohr's vision.

### Bohr's Vision of an Open World

Already under the Nazi occupation, and in the course of his work with refugees he brought to Copenhagen, Bohr had been worrying a lot about the problems of a sick world. In occupied Denmark, he was cut off from the rapid technological developments in the U.K. and the U.S.A. following the discovery of fission. But when he escaped and went to the U.K. and the U.S.A. at the end of 1943, he was quick to see the implications of these developments for the future of mankind. As early as the beginning of 1944, after his first visit to Los Alamos, we find him writing to Sir John Anderson, the Director of the British atomic energy project: "I am convinced that no kind of customary measures (of control) will suffice ... and that no real safety can be achieved without a universal agreement based on mutual confidence".<sup>6/</sup> At this time, Bohr was one of the very few scientists to raise these big issues of the political implications of the bomb in the making.

In his Open Letter to the United Nations,<sup>2/</sup> in June 1950, Bohr presented his "considerations regarding the adjustment of international relations required by the modern development of science and technology". He points out that "... the very necessity of a concerted effort to forestall ... ominous threats to civilization would offer quite unique opportunities to bridge international divergencies". He goes on to say that "the prevention of a competition prepared in secrecy will ... demand such concessions regarding exchange of information and openness about industrial efforts including military preparations as would hardly be conceivable unless at the same time all partners were assured of a compensating guarantee of common security against dangers of unprecedented acuteness". He made it clear that what he was talking about was an "arrangement guaranteeing common security without excluding anyone from participation in the promising utilization of the new sources of natural prosperity". (emphasis added)

While thus advocating an open world, Bohr did not underestimate "the intricate technical and administrative problems" and "the grave causes of disagreement due to conflicting attitudes towards social and economic problems". The main point of his argument, however, was that "the accomplishment of the project would not only seem to necessitate but should also, due to the urgency of mutual confidence, facilitate a new approach to the problems of international relationship". To him, "the potentialities of the project as a means of inspiring confidence just under these circumstances acquired most actual importance". "Moreover, the very novelty of the situation should offer a unique opportunity

of appealing to an unprejudiced attitude, and it would even appear that an understanding about this vital matter might contribute most favourably towards the settlement of other problems where history and tradition have fostered divergent viewpoints."

Further, "with regard to such wider aspects, it would in particular seem that the free access to information, necessary for common security, should have far-reaching effects in removing obstacles barring mutual knowledge about spiritual and material aspects of life in the various countries, without which respect and goodwill between nations can hardly endure."

Thus, in advocating openness, Bohr was not thinking of security and peace in a narrow sense, but he saw "openness as a primary condition for the progress and protection of civilization".

Bohr came back to these issues in his letter to Dag Hammarskjöld<sup>4/</sup>: "Full access to information regarding conditions in every country for life in all its aspects and free intercourse and exchange of opinion across all boundaries must form the foundation for that co-operation in confidence between nations, which in our time is so vital for the future of mankind. Indeed, it is only by such co-operation that the promises for improving the welfare of people all over the globe, held out by the developments of science, can be fulfilled and the menace to civilization from the new powerful means of destruction can be eliminated". One may notice that Bohr is here essentially remarking on the connection between disarmament and development, which has got emphasized in recent years: only an open world could be a disarmed world; but that openness must include co-operation which implies non-exploitative relationships, to promote human welfare everywhere.

As for the first operational step towards an open world, Bohr thought that "the countries which had pioneered in the new technical development might, due to their possibilities of offering valuable information, be in a special position to take the initiative by a direct proposal of full mutual openness".

The issues raised by Bohr and the measures suggested by him had far-reaching political implications. While Bohr thought a lot about the political aspects, he had almost no experience of politicians; and his efforts to persuade Churchill and Roosevelt to take a long-term view of the prospects opened up by atomic energy, ended in a dismal failure. In fact, an aide mémoire signed

by Churchill and Roosevelt on 18 September 1944, after their meeting at Hyde Park, includes the statement that enquiries were to be made about the activities of Professor Bohr and steps taken to ensure that he was responsible for no leakage of information, particularly to the Russians.<sup>6/</sup> Churchill put his doubts about Bohr even more forcefully to Lord Cherwell: "The President and I are much worried about Professor Bohr. How did he come into this business?... It seems to me Bohr ought to be confined or at any rate made to see that he is very near the edge of mortal crimes".<sup>6/</sup>

Bohr himself came away from the meeting with Churchill on 16 May 1944, "greatly disappointed at the way the world was apparently governed, with small points exercising a quite irrational influence". "We did not speak the same language", said Bohr afterwards.<sup>6/</sup>

Bohr continued these personalized efforts until 1950, and so long as he had a hope of success, he was reluctant to take part in the public debate on the nuclear question. In June 1950, however, he felt that the time had come to go public, and he issued his Open Letter to the United Nations.<sup>2/</sup> This letter is an eloquent testament to the vision of this great man. Einstein had once observed about Bohr: "He utters his opinions like one perpetually groping and never like one who believes to be in possession of definite truth".<sup>7/</sup> Not so on the nuclear issue.

### Ideals and Reality

Bohr was aware that his plea for an open world would be dismissed as utopian. "The ideal of an open world", he observed, "with common knowledge about social conditions and technical enterprises, including military preparations, in every country, might seem a far remote possibility in the prevailing world situation. Still, not only will such a relationship between nations obviously be required for genuine co-operation on progress of civilization, but even a common declaration of adherence to such a course would create a most favourable background for concerted efforts to promote universal security."<sup>2/</sup>

"The goal to put above everything else" said Bohr, "is an open world where each nation can assert itself solely by the extent to which it can contribute to the common culture and help others with experience and resources".

As Wheeler has remarked, "few men have the vision and courage to try to induce all mankind to accept a new moral concept of such scope - the principle of the open world".<sup>8/</sup>

The wellspring of Bohr's ideal can be traced to his firm belief that "the fruits of scientific research, which through the ages have so largely enriched our life, are a common human inheritance", and the abiding faith he had in the potentialities of international scientific co-operation. Unfortunately the phrase 'common heritage of mankind' evokes antagonism among the privileged of today.

It would not be in the spirit of Niels Bohr to quote from him and stop with a mere homage to him for his wise words. We have to take up the thread from where he left and look at the world scene today against the back-drop of his vision.

When Bohr made his fervent plea for an open world, he had in view mainly the problems of openness between the East and the West. The process of decolonisation had barely started when he wrote his Open Letter to the United Nations, and the new dimension of openness in transactions between the North and the South had not yet emerged as a problem. International scientific co-operation has certainly contributed substantially to building up the scientific and technological capability of developing countries, and to the solution of specific developmental problems. Yet, by the year of his death in 1962, just before the 1963 U.N. Conference on Science and Technology for the Benefit of Less Developed Areas, held in Geneva, developing countries were expecting much more from such co-operation. It was then widely believed that massive transfer of science and technology from the developed countries would rapidly reduce poverty, hunger and disease in the developing countries of the world. As the preamble to the Pugwash Guidelines for International Scientific Co-operation for Development<sup>9/</sup> states: "This view has proved to be wrong. Access to the technology of the developed countries has been found to be much more difficult than was envisaged at that time... Developing countries note with concern the increasing pressures in the developed countries with market economies to put bans on export of technology, materials, and equipment components, and are worried that technology may be used as an instrument of global domination."<sup>9/</sup>

These aspects of the situation led the Pugwash movement to propose a Code of Conduct on Transfer of Technology (1974) and later the Guidelines for International Scientific Co-operation for Development (1978) mentioned earlier.

The Code of Conduct has been painfully pursued at UNCTAD at intergovernmental level for over ten years. The Pugwash Guidelines paved the way to the Vienna Programme of Action adopted at the U.N. Conference on Science and Technology in Vienna (1979). But very serious difficulties continue to bedevil its implementation, in the absence of a political will to set up the U.N. Financing System for Science and Technology for Development,<sup>10/</sup> agreed to in Vienna, and then in the General Assembly of the United Nations.

Science and Technology have been playing an increasing role in the North-South dialogue, which has sometimes been described as the dialogue of the deaf. Among other issues that have featured are the role of transnational corporations, leading to the creation of a U.N. Centre on Transnational Corporations and also to negotiations on a Code of Conduct for Transnational Corporations; the long drawn-out negotiations at the Law of the Sea Conference with their final outcome; the negotiations on Industrial Property Rights at WIPO and on Reverse Transfer of Technology at UNCTAD; and so on.

All these negotiations have again and again met with deadlocks, with very little manifestation of a real desire on the part of the North to help the South on to a rapid self-reliant development and growth. It is difficult to avoid the conclusion of the 1978 Dag Hammarskjold seminar, namely that the only purpose of these North-South negotiations has been to 'talk the Third World to death'.

'Free access to information', on which Niels Bohr laid so much stress is still a distant dream. The problem is not confined to North-South relations to which I referred earlier. Even among the market economy countries there are increasing secrecy restrictions in several domains of science and technology. Bowing to pressure from U.S. Federal Authorities, and individual scientists under contract to the Department of Defence, universities and scientific groups in the USA are beginning to close the doors to their own conferences.<sup>11/</sup> A recent report in Science summarized the hearings held in June 1985 by the House Science Policy Task Force in the U.S.A. The hearings conducted by Don Fuqua, Chairman of the Committee on Science and Technology, focussed exclusively on Big Science and more especially on the areas of high energy physics and magnetic fusion. The report observes: "The general message was that the political and economic environment has become increasingly unsympathetic to international co-operation over the past 20 years".<sup>12/</sup> (emphasis added)

### Disarmament and an Open World

I have no time to discuss the disarmament issues as such, though they were the starting point of much of Bohr's discussion of an open world. I will only say that nuclear disarmament has to be a part of General and Complete Disarmament (GCD), and GCD cannot be achieved until the developing countries, through purposefully enhanced economic and technical co-operation among themselves (ECDC and TCDC), get rid of their present burdens of poverty and dependency, and stop behaving as mere pawns in the games of the big powers. Enlightened elements in the North too, if they are really concerned about a nuclear holocaust, have to see that the fight for a New International Economic Order and for a restructuring of the global system is complementary to the struggle for GCD. The peace movements must therefore advance beyond mere emotional appeals on the basis of horrid scenarios of the aftermath of a nuclear holocaust. They must study in depth the societal dynamics and the compulsions of the realpolitik of conflicting global interests of the big powers in this supposedly post-colonial era, because of which the movement for peace has made no progress over the last 40 years, in spite of the appeals of personalities of the stature of Bohr, Einstein and Russell. The main issue is nothing less than that of geopolitical domination and of continued access to oil and other resources and markets of the Third World. Development and disarmament are intimately connected, as Bohr had hinted. Bohr's open world is impossible without renunciation of the current concepts of hegemony and spheres of influence.

### Retreat from Multilateralism

It may be appropriate to comment here on the systematic down-grading of the United Nations and of the multilateral institutions that has been going on in recent years. I do not have to remind you here, meeting under the auspices of Unesco, that the multilateral system under the United Nations is today in a state of deep crisis and under attack from the rich industrialized nations. Unesco and UNCTAD are under special attack because they have given importance to issues like disarmament, a new economic order, a new information order, transnational corporations, codes of conduct, etc. A brief discussion of Bohr's concept of the open world above led us naturally and inescapably to all these issues. These issues have to be looked at holistically. To ignore the nexus between education, science and culture on the one hand (supposed to be the main mandate of Unesco), and disarmament issues and North-South relations on the other, is to take a narrow, unrealistic and purely mechanical view of the mandate. It would be like Churchill's dismissal of Niels Bohr, admonishing him 'to keep politics out' of his memoranda.<sup>6/</sup>



To turn away from Unesco, UNCTAD, GATT, etc. is to turn away from universal co-operation and to reject the democracy of international relations in world bodies. Scientists who believe in international co-operation must reassert their faith in multilateral institutions.

### Complementarity of National and International Obligations

While international scientific co-operation was part and parcel of Niels Bohr's daily life, ever since his rich experience of it around Rutherford in Manchester in 1912, Bohr's internationalism was deeply rooted in the soil which had nurtured him. He often stressed that a man, like a nation, derives his identity and inward quality not from the genes he inherits, not from the colour of his skin, but from the traditions and the sense of values imparted by his family and the civilization in which he lives.<sup>8/</sup>

Bohr valued deeply the Danish way of life, and found it impossible to break his ties with Denmark, in spite of very attractive opportunities that naturally presented themselves to him from time to time. On 17 November 1918, soon after the end of World War I, Rutherford wrote to Bohr: "The universities are likely to see considerable development. You may have heard we have initiated a Ph.D. degree. We also plan to make Manchester a research centre for modern physics", and offered him a professorship in mathematical physics, adding "I think the two of us could try and make physics boom" (emphasis added). Since such a temptation is not so uncommon for a Third World scientist, it is worth reproducing Bohr's reply at some length "You know that it has always been my ardent wish to be able to work in your neighbourhood and to take part in the enthusiasm and imagination which you impart to all your surroundings and of which I have so much benefitted myself. At the same time, I am not in a position to accept the splendid offer... The fact is that I have morally pledged myself to do what I can to help in the development of the scientific physical research here in Denmark... I should like so much to settle down in Manchester again and I know it would be of the greatest importance to my scientific work, but I feel I cannot accept the post you write about because the university has done all that they could to place all external means necessary for my work. Of course, the pecuniary means, personal allowance as well as that to the running of the laboratory, will be far below the English standard. I feel it is my duty here to do my best, though I feel very strongly the result will never be the same as if I could work with you."<sup>5/</sup> (emphasis added)

As years went by, there were more offers of professorships in Berlin (1920), Cambridge (1923), and in the U.S.A. (1924), each with the incentive of a much higher salary and in most cases far better conditions of research. But these too were resisted.

During the Nazi occupation, Bohr felt very keenly the responsibility placed on him. He rejected offers to continue work under more favourable conditions in the U.S.A. Instead, during the early period of the occupation, he assisted in a national morale-boosting effort - the publication in 1941 of the first volume of 'Denmark's Culture in the Year 1940', for which he also wrote the introduction.

In the middle of 1943, Bohr got a secret message from James Chadwick inviting him to the U.K. Even at this stage, he was reluctant to quit Denmark. His reply was: "I feel it my duty in our desperate situation to help in resisting the threats to our free institutions and in protecting those scientists in exile who have sought refuge here."<sup>5/</sup> It was only after the resignation of the Danish Government, when his arrest by the Nazis appeared imminent, that he narrowly escaped to Stockholm. He returned to Denmark as soon as the war was over.

#### Concluding Remarks

Amidst the realities of day-to-day life, we tend to forget our heritage and the visions provided from time to time by extraordinary individuals. Niels Bohr is part of our heritage, and his vision of an open world is part of the legacy he has left behind. Scientists and science have benefitted immensely from the insights provided by Bohr into the interior of the atom and the nucleus, and from his epistemological contributions which have illuminated the workings of nature at the micro-level. His vision of an open world was a scientist's and thinker's vision, and it has to be promoted by scientists. It cannot be left to the mercies of politicians and the members of the military-industrial-academic complex. Scientists are supposed to be a segment of humanity in league with the future. The best way that the scientific community could commemorate the centenary of this great man would be to dedicate itself to the fulfilment of his vision of an open world - which has also to be a restructured world. Let us remember his words: "the effort of all supporters of international co-operation, individuals as well as nations, will be needed to create in all countries, an opinion to voice, with ever increasing clarity and strength, the demand for an open world."<sup>5/</sup>

Weisskopf has commented: "He did many things that today seem naive ... but it is this naïveté that carries the hope and the strength for a peaceful future."<sup>13/</sup>

We could conclude with the words of Niels Bohr:<sup>2/</sup> "The aim of the present account and considerations is to point to the unique opportunities for furthering understanding and co-operation between nations which have been created by the revolution of human resources brought about by the advance of science, and to stress that despite previous disappointments these opportunities still remain and that all hopes and all efforts must be centred on their realization."

Notes and References

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