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INSTITUTE OF CURRENT WORLD AFFAIRS

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CHGO-37
The Scientific Revolution and China

December 2, 1964.

Mr. R.H. Nolte,
Institute of Current World Affairs,
366 Madison Avenue,
New York 17, N.Y..

Dear Mr. Nolte,

Caryl Haskins, in his book The Scientific Revolution and World Politics, makes the point that when the scientific revolution first occurred in Britain in Newtonian times it had the effect of completely transforming the society. Within a period of forty years the way of thinking of even ordinary people changed entirely. Before, decisions were based on superstition, intuition, and faith. After, men thought rationally. The consequences were profound. Haskins asks what will happen when the people of the less developed world also accept science as a way of life, and make their decisions on a rational basis, will the consequences be equally profound?

He suggests that the possible implications of a scientific revolution in developing countries are three-fold. First, a genuine scientific revolution can be expected to bring a world view so radically new that it may well transform the outlook of those who experience it. Secondly it can bring the realization that not only can the laws of nature be understood by man, but also that they can be used for man's practical gain. Thirdly, a society dominated by science sets a high value on the search for truth. This may have important social consequences since the search for truth must give high value to the independent mind. Conversely, a traditional society in which all knowledge is "revealed" is cut off from well-springs of renewal and power of evolution, and this may be its basic handicap as it seeks to enter the modern world.

In every Asian country that I visited during this past year I found scientists who were deeply concerned about how to bring about in their own country, the sort of scientific revolution that Haskins discusses in his book. In some places, such as India, it was regarded by some of the top scientific administrators as one of the most crucial of the many problems facing Indian science today(1). Not only is it a problem to create a science consciousness among the broad masses of the people (to use the Chinese phrase), but many practising Indian scientists are still deeply superstitious, a fact which causes great concern to their more "liberated" colleagues(2).

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(1) A report by the Council of Scientific and Industrial Research to a recent UNESCO conference stated, "The major problem of India, like other developing countries, is the creation of a climate of opinion favourable to science. Science and technology cannot foster unless people have a scientific temper. To this task we are now devoting the resources of the country."

(2) See CHGO-27: Science in India, I.

Scientists in the Philippines were also unhappy about the lack of science consciousness among Philippinos, and the same was true in Thailand and Nepal. Many of these countries do have first rate scientists and excellent laboratories, but the fruits of science are not having the impact on the development of the society that they should have. One of the main reasons is the unscientific attitude of the people.

China is closer to achieving its scientific revolution than any of the other Asian countries I have visited (apart from Japan). Nowhere else did I meet such a spirit of research pervading the whole society. This, to my mind, is one of the most significant features of present day China. I believe its implications are profound. The manifestations of this research spirit could be seen in every commune and factory that I visited.

"Model Worker" with his own invention in the October Commune

For example, as we walked through the carpenters shop in the October Commune in Nanking, a man operating an automatic planing device was pointed out, "He invented that himself, he is a model worker." The automatic band saw in another commune near Shanghai "we designed and built ourselves." Every commune I visited (seven in all) had its own experimental plots and two had their own research institutes. Admittedly the latter were very crude, but research (simple experiments) was being done by the peasants themselves. In the commune I visited near Canton, 200 people were working on the experimental fields, only two of these were university trained, the rest were "veteran peasants". At the Tang Wan Commune near Shanghai I was taken to see one of the experimental plots. There were a variety of experiments, different seeds,

Left: Director of Agricultural Science Research Institute at the October Commune, Nanking, shows me the seed germination experiment.

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Below: The Agricultural Research Institute building at the October Commune, Nanking.

different densities of sowing, different times of fertilizer application. I asked if, when a particular combination was found to be the best it was then applied the following year over the whole commune. The answer was, "No, the soil conditions vary, and so we have several such experimental fields." In factories it was the same story of innovation and constant striving for improvement.

One of the most interesting illustrations of how the peasants are encouraged to experiment came when I visited the Kiangsu Branch of the Chinese Academy of Agricultural Science in Nanking. This was a well equipped, obviously genuine research institute staffed by 400 research scientists with university training, plus four peasant scientists. It had 28 branch institutes scattered throughout the Province. I shall discuss the work of the institute in another letter; what I want to mention here is the role of the peasant scientists. These are men with no genuine scientific training, but experienced peasants who had found empirically that certain techniques work well. The most famous one is a man called Chen Yung-Kang. He was brought to the Institute, given some land, and told to experiment with his method of growing rice. It seems that this was given a thorough vetting by his scientifically trained colleagues, found to make good scientific sense, boiled down to a simple slogan-like technique and called Chen Yung Kang's "Three black and three yellow method." He was then set up with a large experimental field near Soochow to grow two different types of rice, but both according to the "Three black and three yellow" technique. Last year, 90,000 peasants were brought in from all over China to see this demonstration.

When I visited Soochow I asked to see the field. It was outside the city limits and meant

Chen Yung-Kang

Chen Yung Kang's experimental field near Soochow

getting another permit for me, but this was done. I wanted to see how the logistics problem of getting 90,000 peasants to visit an experimental field had been tackled. It was quite simple, the field was alongside both a road and canal, and both trucks and boats were used. The significant thing was that a peasant was being used as an intermediary. Other peasants were shown that one of their own kind had innovated successfully. They were much more likely to go back to their communes and try to emulate a successful colleague than try a new technique suggested by a government scientist.

These are just a few of the many illustrations of science brought to the people that I saw on my trip to China. Several different techniques are used, both to create the interest in science, and then to satisfy the demand to know more about it.

The first of these techniques is conventional education. All the communes which I visited had at least one middle school (high school) where physics, chemistry, and biology, were taught. The standard was not very high at these schools, but every school had a fairly good supply of basic science demonstration equipment and the simple apparatus for individual experiments in electricity, and the properties of matter, and simple chemistry. In the cities the schools were much better and I will describe those in a subsequent letter.

The second feature of this education drive is the spare time schools. These are mostly night schools, although part-work part-study schools are also operated by some factories during the day. The spare time schools give an opportunity to workers to continue their education in selected subjects from primary up to university level. These seem to be mostly operated in the cities, although some of the communes also operated spare time schools during the winter months. These schools are voluntary but about half the employees in each factory I visited were making use of the opportunity for further education.

Thirdly, there are exhibitions and displays of posters. The most striking exhibition on the science theme that I saw was in the Great World in Shanghai. (People who knew Shanghai in the old days may recall that this was one of the greatest centers of sin in the Orient. Now it is very respectable! Although still used for entertainment, it is mainly acrobatics and Chinese operas.) The exhibition was to show the "Smashing of Superstition" and to prove there are no ghosts in China. The foreword said, "Superstitions were a technique used by the feudal rulers to control and extort money from the peasants. Now it has been replaced with science, and with science, man can control nature." The exhibition consisted of a series of charts and models which gave the scientific explanation of old superstitions. Birth marks, it was explained, were not caused by being kicked by ghosts, as was previously believed, and it was not a ghost pulling out hair that made a person bald. There were displays refuting geomancy, models of the human body, and several displays showing how weather is formed and how man can sometimes control it (i.e. make rain). I saw other less

Display of pesticides in a brigade headquarters at Tang Wan Commune, Shanghai.

elaborate displays in communes which explained the scientific reasons for public health measures and explained about pesticides.

The fourth technique is the use of slogans. I find it very hard to assess how effective slogans are, but they are omni-prescent in China. Always the same ones are repeated over and over again in every city and village. The most popular ones were: "Oppose the American Imperialists"; Oppose the New Revisionists"; "Rely on our own efforts"; and "Realize the three great revolutionary movements of, the class struggle, the struggle for production, and scientific experiment". Everywhere I went I was told of the importance of combining theory with experiment. It was this constant repetition of what to us, schooled in the Western tradition, seems so obvious, that first made me recall Caryl Haskins' words about the scientific revolution. Our own scientific revolution took place 300 years ago, only after people like Bacon and Newton demonstrated the value of combining theory and experiment. In China this combination never took place and it is a new concept to most Chinese. It most surely marks the beginning of the Chinese scientific revolution.

Another way that is used to encourage innovation and research at an elementary level is the system of rewards. Successful innovators are singled out for much publicised praise and known as model workers. At a higher level premiums are given for technical innovations, as well as for inventions which relate to the advancement of science.

But the most important way that is used to encourage research and innovation on a mass scale is also the most difficult for those of us brought up in a non-communist society to understand. This is the use of political indoctrination. Before I went to China I could make no sense at all of the reports I read on technical innovations made as a result of political study. Then

in interviews with factory managers and directors of schools I started getting the same story. But it was in general terms and there was nothing specific until I visited the Number 17 Textile Factory in Shanghai. This was an old factory built in 1921 (I noted as I walked round that most of the cotton spinning equipment was built by Platt Bros., Oldham, Lancashire, 1922) and much of the machinery was still old. "But," said the manager, "after studying the works of Chairman Mao the workers found a way to increase the speed of the spinning machines from 9,000 revolutions per minute to 13,000 revolutions per minute." Here was a specific example, so I pounced! "This is indeed very interesting, could you please tell me which particular passage of Mao's writings the workers used, and could you take me step by step from this political passage to the very specific technical innovation you have just mentioned?" The interpreter and Party secretary, who was taking notes, both chortled at this question, but the manager remained serious, "Sh jeh yanq ..." It's like this ... and then he went on at great length about Mao's writing, but what it boiled down to was that Mao says "All things are possible". There was no specific passage but his point was very roughly as follows (admittedly he did not put it quite like I do): After Liberation this factory faced a number of problems. It was an old factory, the machinery was old, and the workers were relatively old -- "We called ourselves the 'Three Olds'". Improvement and modernization was sorely needed. The machinery, though old, still worked reasonably well and it would have been wasteful in China's condition to throw it away. But the people were the main problem, they had been brought up in the old society and had been trained to operate a machine. It never occurred to them that the machine could be improved, let alone that they themselves could ever find a way to do it. It would take too long to educate them and give them the scientific background that exists in the West, but some technique was needed which would lift them out of their rut.

Political indoctrination was the answer. All the workers were required to study politics in their spare time. Lectures were given and discussion groups organized. The workers were taught the communist ideals of a classless society, everyone working not for himself but for society as a whole. They studied the works of Chairman Mao and gradually "the level of their class consciousness was raised, their political awareness improved." They said "We must build a new country."

Before, they did not think it was possible to improve their lot. They did not dare to think that improvements could be made. Now they "Dare to think, and dare to do", their spirit is new, vital and alive, Chairman Mao has liberated their thoughts. With this new spirit they look to see how they can improve their work and their knowledge. Their thirst for knowledge is met by the spare time schools and universities. Once they believed it was possible to innovate and improve they found many places in the factory where relatively simple innovations improved quality and productivity. One worker studied the problem of the spinning machines and found a way to increase the speed from 9,000 to

13,000 revolutions per minute.

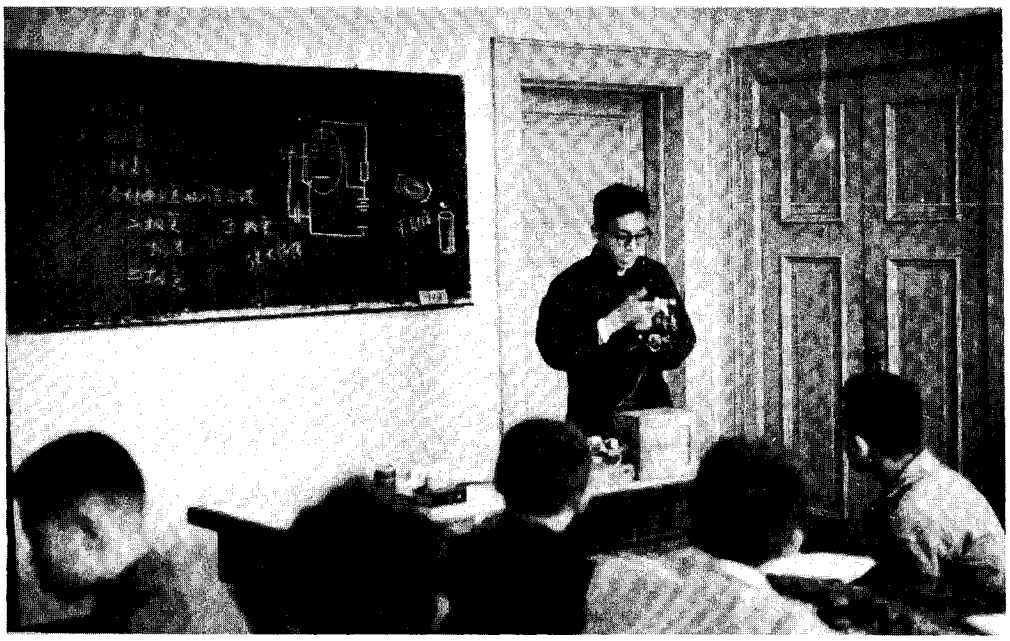
I thanked the manager for his explanation and said, "In the West we also believe that technical problems can always be solved, but we believe this as a result of our scientific knowledge and experience. We do not need politics or Chairman Mao to tell us. Also we believe competition is the best incentive for innovation. But your explanation has helped me to understand the Chinese approach and I am most grateful." He answered, "I do not know about conditions in the West, I only know what is best for Chinese conditions. Probably there are several ways of achieving the same ends."

Whereas I could understand this approach of using politics to imbue the masses with a scientific spirit, I believe the real tragedy of the Chinese communist experiment is seen when these same techniques of political indoctrination are forced on the intellectuals. To hear the headmaster of the best secondary school I saw in China say that after studying the works of Chairman Mao the teachers had found a way to cure the children of near-sightedness was very sad. Mao says that teachers should look after the all round development of the children. When they read this the teachers realized this included the childrens' health, which included eyesight. Therefore they set to and improved lighting conditions and laid down rules about the length of time a student was allowed to study at a stretch. But to give the credit to Mao was, to my mind, plainly ludicrous.

The results of this spirit of research among the people has not always been successful and has sometimes led to drastic mistakes. In the short run it might even have done as much harm as good. The backyard blast furnaces, deep plowing, killing of sparrows, are all examples of innovations from the masses that went wrong. The society has still to find the best way of using its relatively few genuine scientific and technical experts. But as the general technical level of peasants, workers and political cadres, improves, the number of mistakes is likely to decrease and the number of really successful innovations increase.

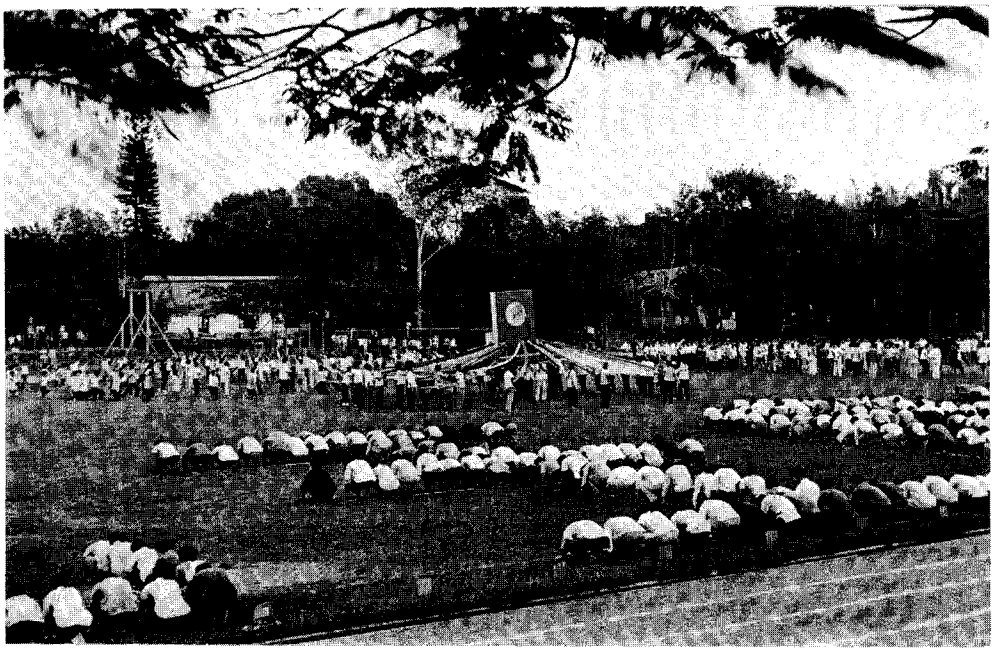
The whole Chinese approach to development and the use of science was expressed symbolically in a dance drama that I saw in Nanking. As with almost all entertainment that I saw in China it was professionally excellent but nauseatingly political in content.

It was the story of two girls who had just graduated from middle school and were chosen by the State to work on a commune. For almost three hours we were entertained (?) by various dances depicting the life on the commune, with the two girls learning to use carrying poles, learning how to plant rice seedlings, etc.. One girl quickly got the hang of things, but the other did not, she became unhappy and thought about running away. There were long sequences where her friend tried to talk her out of it and the poor girl went through agonies of indecision,



An instructor explains how radio tubes work to young pioneers at a childrens' palace in Shanghai. The children are all under 15 years of age. (The childrens' palaces are a type of communist youth club)

Biology store room in the October Commune Middle School, near Nanking. (Note demonstration models on top of cabinet).



The Red and Expert. University students at Sun Yat Sen University, Canton, practise for a political display which was planned for the following week to commemorate the fortieth anniversary of the founding of the University. The students crouching in the foreground are forming characters. The one shown in its entirety is 主 (juh) and forms part of the slogan "Mao juh shyi wann suey" -- Long live Chairman Mao. In the center of the field, students parade maypole style around a huge model which represents one of the volumes of the Selected Works of Mao Tse-Tung.

but finally she made up her mind to quit and go home. As she left, a terrible storm came and all the peasants rushed to man the dikes. One peasant saw the girl running away and gave her his coat to protect her from the rain. She was so moved by this act of generosity by someone who should really have despised her, that she realized what a heel she was and rushed to help. As she did so the storm ceased and in a gesture of approval the sun came out. She had been remoulded, and became a fully fledged member of the commune. The last scene of the dance drama was the harvest festival which also marked the first anniversary of the girls' arrival. In a special ceremony the headmaster of their middle school (representing the State) came and gave them each a graduation present. To one girl he gave The Selected Works of Chairman Mao, and to the other, an enormous microscope. In a symbolic finale, with thundering music, the two girls holding high their presents led the way to the "future" followed by the Party secretary, brigade leader, and all the members of the commune. Thus indicating the way to the future lies in a combination of politics (works of Mao) and science (the microscope).

It can be argued that the type of innovation discussed in this letter is nothing more than technological innovation of which the Chinese have had a long history of accomplishment, and that genuine scientific research is quite another matter. This is true, but technical innovation involves research and it is this spirit of research which helps to create the scientific temper. The Indian report to UNESCO stated "Science and technology cannot foster unless the people have a scientific temper." The Chinese are doing their utmost to develop simultaneously both this temper and genuine scientific research. In both, the Chinese Government is insisting on a combination with politics -- "Be Both Red and Expert" is the slogan.

But in the long run, are redness and expertise compatible? Will the emphasis on science and rational thought topple the conformity and one-sided view of communism (as perhaps it is now doing in Russia)? Or will the latter eventually stifle free creative scientific thought and discovery? If Haskins' views on the significance of scientific revolutions is correct it is difficult to see how the two can thrive together ... or can they?

Yours sincerely,

C.H.G. Oldham

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Photograph of Chen Yung-Kang from China Reconstructs.