MATHEMATICAL LIFE IN THE DEMOCRATIC REPUBLIC OF VIETNAM

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I. At the beginning of this year I received through intermediaries a request from some mathematicians of the D.R.V.[1] for all the preprints at my disposal in the fields of algebra and algebraic geometry. As is undoubtedly the case with many of my "western" colleagues, until then I had not known that a mathematical life existed in the D.R.V., and *a fortiori* had not known of Vietnamese colleagues desiring to become up-to-date in a branch of modern mathematics like algebraic geometry, which does not have the reputation of being easy. It goes without saying that I was delighted to be able to be of use to our Vietnamese colleagues, and I made haste to send them, in addition to all of the papers that I had personally, also all of the available mathematical works published by I.H.E.S. Incidentally, after my recent visit to the D.R.V. I can report that all of this material has arrived at its destination, and that, moreover, some of it is being utilized by the mathematicians there.

This first indirect contact gave me the idea in May of this year of proposing a visit to the D.R.V. of two or three months to give mathematical courses or seminars whose theme and level would be determined after my arrival, depending on need. I submitted this proposal to Mai Van Bo, Deputy General of the D.R.V. in France, who reacted very favorably and transmitted it to the appropriate authorities in Hanoi. Much to my surprise — and

[1] After reunification in 1975, the official name of Vietnam changed from the Democratic Republic of Vietnam (D.R.V.) to the Socialist Republic of Vietnam (S.R.V.). The frequent use of the designation "D.R.V." rather than simply "Vietnam" in this report is to distinguish it from South Vietnam, which at that time was under U.S. occupation. (*Editor's note.*)

despite the difficulties of organizing a series of lectures by a foreigner in the D.R.V. under the present conditions — in early October I received an invitation from the Mathematical Society of Vietnam for the month of November 1967. From I.H.E.S. I received a leave of absence and, even better, a grant for travel expenses, which (for lack of foreign exchange) could not be covered by the D.R.V. It later turned out that the Cultural Relations Department of the Foreign Ministry in Paris did not raise any objection to taking responsibility for the expenses of the trip.

Unhappily, through a lack of coordination between the different agencies involved, after leaving Paris on 31 October I had to wait a week and a half in Phnom Penh (Cambodia) before I was able to reach Hanoi on 10 November on the International Control Commission's weekly flight, which is the only plane to fly between Phnom Penh and Hanoi. I left Hanoi on 1 December, so that I ended up spending twenty-one days in the D.R.V., i.e., three weeks. The purpose of my report today is to highlight some of my impressions and observations during this stay in Vietnam, which, though rather short — too short for my liking, since the country is extremely endearing — was rich in vivid and varied impressions.

II. My stay was organized as follows. For one week (more precisely, nine days) I remained in Hanoi giving lectures of a general nature to a relatively large audience of about sixty people in the first days, not only mathematicians but other scientists as well (at least there were some physicists). I then spent a week and a half at Hanoi University in evacuation outside the city (about 100 km from the capital); this time was largely devoted to a more specialized seminar on categories and homological algebra, with thirty to forty listeners, most of whom had followed me from Hanoi after attending the general orientation lectures. Because the instructors in Vietnam often have a heavy work load, those who were supposed to attend my talks had been excused from all of their other obligations (teaching and various chores) for the duration of my visit. Virtually all of the auditors came, in approximately equal measure, from the two great parallel (and more or

less equivalent, it seems) institutions of higher learning in the D.R.V. — Hanoi University and the Pedagogical Institutes (in Hanoi and Vinh) — both of which have been evacuated to various parts of the countryside. So it was necessary for both groups to make it first to Hanoi (almost always by bicycle, which at present is the universal means of transportation in Vietnam), and then to the university in evacuation, which had to provide lodging, food and transportation for my hosts who had come from other locations. Add to this the attentions with which the speaker, like any foreigner visiting the D.R.V., was surrounded and which involved an official of the "State Science Committee" who was attached to me for the entire duration of my stay, watching over my security, comfort and special needs and desires; plus a driver during my stay in Hanoi, who was relieved by a cook for the period in the countryside — all three of these people, as one can imagine, being very much underemployed during their time in my service. One can start to get an idea of the organizational questions that arise from a harmless three-week lecture visit to the D.R.V. This is typical of the effort that is systematically expended throughout the D.R.V. in order to promote education at all levels, under very difficult conditions and despite the needs of national defense.

Like most more or less public activities, the lectures were scheduled between about 6 and 10 a.m., because the bombing usually took place later in the day, rarely before 11 a.m. During most of my stay the sky was cloud-covered, and consequently there were few bombing raids. The first serious bombardments had been anticipated; they took place on Friday 17 November, two days before we left for the countryside. Three times my talk was interrupted by alarms, during which we took refuge in shelters. Each alert lasted about ten minutes. Something which is at first very striking to the newcomer is the great calm, almost indifference, with which the population reacts to the alarms, which have become a daily routine. I had the opportunity to observe many people during the alarms, both in the street and in the shelters, including children and old people, and I never encountered the least sign of nervousness among them. It should be noted that things are extremely

efficiently organized to reduce to a minimum the number of bombing victims: individual and group shelters everywhere in town, a very tight street-by-street and block-by-block organization of responsibility in case of an air raid, including first aid — a small red cross flag indicating the presence of a first aid station, which otherwise is carefully hidden beneath a protruding roof so as to avoid detection by enemy planes! One senses a great confidence in the populace — in the effectiveness of the air defense, for example — and a general interest in discussing the number of aircraft shot down (a topic of conversation which in the D.R.V. seems to take the place of the weather) rather than the damage caused by the bombardments (about which, in any case, the radio tends to be rather discreet, for obvious reasons). As soon as the alarm is over, everyone (at least in the neighborhoods that were not hit) returns to their business as if nothing had happened.

During one of the air raids that Friday morning a delayed-action cluster bomb fell right in the courtyard of the Hanoi Polytechnic Institute, and (after the alert was over) it killed two mathematics instructors at the Institute. Tạ Quang Bửu , who is a mathematician as well as the Minister of Higher Education and Technology (and who attended the lectures that I gave while in Hanoi), was discreetly informed of this during the lecture. He left at once; the rest of the audience continued to follow the lecture while waiting for the next alert. The next day's lecture had to be rescheduled for the following week in the University in evacuation, so as not to have large groups of *cadres* in the city during the period of bombardment. This seems to have been the first time since the escalation that mathematics instructors in higher or technical education were killed. There are, I would guess, of the order of two or three hundred instructors, perhaps more. In fact, although each air raid claims a certain number of victims (about twenty, it seems, that Friday), the chances that a given individual will be killed, even over a period of years, are relatively small, as the preceding example illustrates. I have the impression, based on conversations with the Vietnamese, that the families which have lost someone in the bombings during the escalation are the exception, not the rule. Of course, the chances of being killed are

still smaller for a foreign visitor who stays only for a few weeks and for whom maximal precautions are taken to ensure his safety.

My lectures were given in French, which was understood fairly well by about half of the audience (in contrast, almost no one speaks English[2]). Among our young Vietnamese colleagues below the age of thirty, few speak French, while many speak Russian, having gone to the U.S.S.R. for university studies. The lectures were generally translated into Vietnamese by one of the auditors. It should be pointed out that for the past decade or so Vietnamese scientists have been in the process of creating a Vietnamese scientific language in its entirety — a task which, of course, is far from completed. (In mathematics, the first efforts in this direction go back to the mathematician Hoàng Xuân Hãn, who wrote the first French-Vietnamese mathematical dictionary in the 1940's.) The translation of my talks generally went without a hitch, except for the occasional need for a brief discussion in Vietnamese. Tạ Quang Bửu, who was among those most insistent on a perfectly correct translation, frequently interrupted with a quick remark on terminology. Concerning the audience, my impression is that most of them generally understood what I was saying (or what the translator was saying), at least *grosso modo*, and that most followed with interest. In any case, there is no doubt that the translator always understood perfectly, and, moreover, he fulfilled the task of translator to everyone's satisfaction. The translator at first varied according to the theme; but after a few days and by what seemed to be a general agreement on the part of the listeners, the choice devolved upon Đoàn Quỳnh, an instructor at the Pedagogical Institute and certainly one of the most competent and gifted mathematicians among our colleagues in the D.R.V.

The system of simultaneous translation seemed to me to work excellently, and on the whole suited equally well the lecturer and the audience. A sentence-by-sentence translation allows the speaker the luxury of collecting his ideas in an orderly way in the course of the

[2] Now, a quarter century later, this has essentially reversed, with more young scientists studying English than French. (*Editor's note.*)

lecture, without an excessive effort at concentration, at the same time as it enables the listeners to follow at a pace which is more reasonable than that of an uninterrupted talk. Four hours talking at this pace (with two short breaks) seemed to me to be considerably less fatiguing than two hours at the usual pace. But it must be said that the interpreter's work is much more tiring, and at the end of my sojourn in the D.R.V. I was in excellent form and well rested, while Quỳnh was visibly drained.

Notes were taken of all the lectures by Hoàng Xuân Sính, also of the Hanoi Pedagogical Institute, who is one of the few mathematicians (even more unusual, woman mathematicians) to have been educated in France (she received her first degree there in 1959). The plan is to edit and reproduce these notes in France.

The mornings were devoted to the talks, while in the afternoons the auditors frequently met to go over the material treated in the morning, helping one another clarify the points that had not been clear to them. The style of work that is generally and officially observed is to work in groups — and this applies to the sciences as well. While this is excellent up to a point, one can imagine that this style entails some very serious problems when one attempts to apply it at the level of research. I will return to this later.

Most days in the afternoon I received the young mathematicians to discuss various topics with them. They came in groups of two or three, never fewer. Apparently as with absolutely everything in the D.R.V. (at least at present), these meetings were organized with care, as I became aware after a while. The mathematicians who wished to see me first had to inform the "authorities," if they weren't authorities themselves, and make a report on the subject of their interview. Incidentally, I believe that any of the auditors who wanted to talk with me once or several times was actually able to do so. Another example I saw of the communal habits in the D.R.V. was that, toward the end of my stay, a general discussion took place which all of the auditors were required to attend. The purpose of this discussion was for everyone to describe precisely what benefits had been derived personally from the set of talks. Most of us would undoubtedly be embarrassed to

answer such a question if it were asked of us after a talk or seminar!

It might be of interest to give an outline of my talks, for which the selection of topics was worked out jointly with our Vietnamese colleagues:

(1) General orientation talks.

Monday, Nov. 13: Training of mathematical researchers and general conditions for scientific research.

Tuesday, Nov. 14: The notion of a scheme.

Wednesday, Nov. 15: Functional analysis.

Thursday, Nov. 16: Homological algebra.

Friday, Nov. 17: Homological algebra, sheaf theory.

Monday, Nov. 20: Topology (mainly, algebraic topology).

Monday, Nov. 27 and Thursday, Nov. 30: The Weil conjectures (4 hours in all).

(2) Specialized seminars.

(a) Topological tensor products and nuclear spaces (two days).

(b) Homological algebra (seven days).

All of the ideas explained in these talks are in the "well-known" category, and most are available in published form. For this reason, I believe that my visit was more useful in a psychological sense — as a stimulation for our Vietnamese mathematical friends — than in the sense of knowledge actually acquired. I also think that the general orientation lectures were certainly much more useful for them than the more technical talks in the two seminars. In a country which, by force of circumstance, has few relations with the outside (unless one counts the cluster bombs as a form of relations), it is particularly difficult for an inexperienced mathematician to orient himself among the multitude of possible directions, to distinguish what is interesting from what is not. For example, it is useful for them to be made aware of some of the directions in which topology and analysis are currently being pursued, and to hear certain truisms — such as: that general topology should be viewed as an indispensable and precise language and not as a science that calls for further

research, or that functional analysis still offers a certain number of interesting problems for the specialist, but that it is not an area where one would want to spend one's entire life working, etc. Unfortunately, my own lack of competence prevented me from being as useful for the Vietnamese analysts as for the "algebraists." It would certainly be valuable for a seasoned analyst, such as L. Schwartz or B. Malgrange, to make the same sort of visit as I did to the D.R.V. The Vietnamese (both leaders and rank-and-file) told me that they would be extremely glad to receive other French mathematicians, insofar as circumstances permit. Unfortunately, it does not seem that this will occur in the near future, in view of the intensification of the bombing since this past October (which had also caused a cancellation of my November visit; it was only by accident that, not having learned of this cancellation, I ended up landing in Hanoi with the approval of the Vietnamese authorities, who did not want me to have to return to Paris with nothing to show for the trip)!

III. After this general outline of the scientific program and the organization of my stay in the D.R.V., it is time to proceed to the main subject and speak of what I was able to see and learn about mathematical life in Vietnam. The first statement to make — a rather extraordinary statement in view of the circumstances —is that *there is in fact a mathematical life worthy of the name in the D.R.V.* To properly appreciate this "existence theorem," first of all one must keep in mind that in 1954, after the eight-year war of liberation against French colonial occupation (i.e., thirteen years ago), higher education was practically nonexistent in the D.R.V. During the extremely brutal war of 1946-1954, the main effort in education was directed toward achieving literacy for the large masses of peasants, an effort which was carried through to its final goal in subsequent years, until about 1958, at which time illiteracy was practically eradicated in the lowlands. (See "Education in the D.R.V.," in *Etudes Vietnamiennes*, May 1965, which contains a very interesting study of the problems of education in the D.R.V. through 1965.)

At present in the D.R.V., if I am not mistaken, there is one and only one mathe-

matician possessing a doctoral degree:[3] Lê Văn Thiêm, who had completed his thesis in France in about 1948 and then returned to (wartime) Vietnam. Another mathematician, the more or less self-educated Tạ Quang Bửu (whom I mentioned earlier), was at this time fulfilling the duties of Defense Minister (it was he who signed the Geneva Accords for the Vietnamese side in 1954). Thus, it was necessary to create higher education starting essentially from nothing.

The method followed (undoubtedly the only one possible) was to send young people to universities in the socialist countries, especially the U.S.S.R. Among the hundred or so mathematics instructors at Hanoi University and the Pedagogical Institute, about thirty have gone abroad for four to six years of training. They have generally reached the level of a Soviet "Candidate's thesis," which, it seems to me, is slightly below the French degree (there is another, more demanding thesis requirement in order to be entitled to a university chair). This means that they have each published at least one or two original works, generally in a Soviet or East European journal. (In recent years they also publish directly in Vietnamese: in the packet of reprints I received when I departed, some were in Vietnamese.)

Few of the instructors have the rank of full professor; most are assistants. Another thirty or so beginning mathematicians are still abroad, and will return to the D.R.V. in the course of the next few years after finishing their studies. At present two thirds of the teaching staff in mathematics were educated locally during the last few years. These instructors still have had little experience teaching, and even less doing mathematics. The increasing number of mathematics students (five hundred in the evacuated Hanoi University alone) and the scattering of these students because of the conditions after the escalation of the war — as a result of which one needs at least one instructor for each ten students — lead to urgent problems related to the training of instructors. These are the

[3] In the French sense, which is higher than an American Ph.D. At this time there were other mathematicians who had degrees equivalent to a Ph.D.; for example, Hoàng Tụy had a Candidate's Degree from Moscow. (*Editor's note.*)

same problems that arose at all levels of education at the time the D.R.V. was created in 1945. In addition, most of the teachers are more or less fresh out of the exams covering the subjects that they themselves will be teaching, with practically no transition time.

A second circumstance which makes the existence of a scientific life in the D.R.V. all the more extraordinary is the extremely difficult conditions of life and of work created by the escalation of the war by the Americans. One must bear in mind that, except for Hanoi, all the cities of the D.R.V. are practically destroyed, and the imminent destruction of Hanoi itself is anticipated as a probable eventuality soon after the beginning of the year, so that half of the population of Hanoi has been evacuated to the countryside, along with the key administrative services, including education. The various faculties of Hanoi University (and the two Pedagogical Institutes) are dispersed to different villages. The University's presence in this or that village is kept strictly secret, and each village must remain unaware of the instruction that is going on in neighboring villages, indeed even on its own premises. Thanks to the extremely strict discipline, the location of these villages is not always known to the Americans, as a result of which they have not yet been razed by systematic air raids.

Life is very primitive. Everyone — university administrators, teaching staff, and students — live in the same type of straw huts made of bamboo with mud-walls, windows open to the wind, and the sun baking the earth. Some of them live with the peasants and others in communal dwellings, which they usually build themselves. Since there is no electric lighting, they use kerosene lamps; nor is there running water in the homes, so they take water from a well. As is the case in the populace as a whole, very few of the instructors live with their families: the husband works in one region, the wife and children are in evacuation in another, or else she works and the children are entrusted to relatives living in a third location. The family gets together when circumstances permit, perhaps one day a month, from which one must usually subtract about ten hours for the journey (by bicycle, of course). The trip is made chiefly at night, to avoid being strafed. Since

the roads are continually being destroyed and rebuilt, the best form of transportation for a single person is a bicycle, which one can easily carry on one's back to detour around the rubble where the road is torn up. In both the village and the city one lives with the constant possibility of an air attack. Very often when the weather is clear enemy planes fly over the University, occasionally dropping their bombs — haphazardly, so as to get rid of them before returning to base — sometimes wounding or killing some civilians. In the month before my arrival two peasant children had been killed in this way.

One of the villages sheltering the evacuated University and one housing the Pedagogical Institute have thus far not been subjected to regular air attacks. Moreover, as everywhere else, a "self-defense" unit has been formed among the instructors in order to return fire in the event of an air attack. Everyone is required to wear a special hat for protection against fragments from cluster bombs; however, because of the relative calm in the countryside, the safety precautions are not always rigorously observed.

At the same time next to almost all of the huts there are family bomb shelters, dug into the ground with a bamboo roof concealed under dirt; these are very effective against the projectiles and blast of a bomb. Special precautions are taken for lecture and meeting halls, as well as for children's classrooms. They have systems of trenches, usually extending from inside the room, which are hidden from the outside and allow a rapid evacuation of the room without detection by enemy aircraft. Generally the trenches run right next to the benches on both sides of the room, so that everyone can take shelter instantaneously in case of attack. The rooms are most often half buried in the ground, with the above ground part of the mud-walls reenforced by a layer of dried earth about one meter thick to protect against bomb blasts. The part that remains vulnerable is the roof, which easily gives way to the blasts, and especially to the fragmentation bombs, which generally explode at a height of several meters in order to strike the populace with greater efficiency.

The problem of scientific equipment, a simple problem for mathematicians, gives rise to a multitude of difficulties for our colleagues in other departments. However, I saw a

chemistry laboratory in action, with about twenty students engaged in practical experiments by the light of a kerosene lamp (which had been greatly modified, so as to have the intensity of a powerful electric lightbulb). The chairman of the Chemistry Department, Nguỹên Hoàn, took me to his laboratory for me to admire the running water, which was stored in the gas tank of an American airplane that had been shot down nearby (this tank was carefully hidden from view by an overhanging bamboo roof). His students took turns at "pump duty," refilling the tank by means of a hand pump from water coming from a reservoir farther down which was fed by a spring. In case of necessity, in the laboratories they could also obtain electricity from a gas motor.

There are serious limitations in their food, although not as great as those which we knew in France during the last war. People do not look malnourished either in the city or countryside. Work in the fields seems to proceed at a normal pace, with some of the work done at night, when there is little danger of air attack. Both the instructors and students are obliged to do a little animal raising (chickens, rabbits, etc.) and gardening, in order to help solve the food problem: on the average the instructors devote a half hour per day to this, the students more. In general, I have the impression that the *vital needs* for food, clothing, shelter, and medical care are ensured for everyone or almost everyone, not only for the *cadres*, thanks to exceptional organizational efforts and qualities of tenacity.

As I already mentioned, our Vietnamese colleagues have an extremely busy schedule. This schedule generally includes about ten hours of course work per week, to which one must add the transportation time, often rather substantial, in view of the sometimes large distances between the various villages where the courses must be given. In addition, there are quite a few group meetings which it is necessary to attend. Two three-hour sessions a week are devoted to communal discussions whose purpose is to enable the more experienced instructors to assist the novices in solving their teaching problems. Once the general considerations in this direction are exhausted, however, it is hard to imagine what else these meetings could consist of — perhaps at best various practice sessions where the

"elders" help their younger colleagues to solve problems which the latter, in turn, will then give to their students, and at worst an attempt to discover with some degree of conviction what the possible role of dialectic materialism is in various branches of mathematics. One afternoon per week there is also an improvement course on Marxism-Leninism, lasting six hours (two three-hour sessions), which is apparently attended by all of the rank-and-file teachers, including those who have been improving themselves in this branch of knowledge for ten years or more. In general, politics has an extremely strong hold on the individual's personal and professional life, and it is clear that, apart from the conditions caused by the war, this creates for our Vietnamese friends a serious handicap in intellectually creative activity, which demands continual effort and undivided attention.

In addition to these and other political activities which depend upon the circumstances, there are various duties connected with the war: digging trenches, repairing dwellings damaged by bad weather, getting provisions, and working in the garden and tending animals, as mentioned before. With all of this our Vietnamese colleague has barely one day per week to devote to personal work, study, and, if the occasion arises, research. And it is unusual for there to be an entire day that is really free of other chores.

IV. Having given an overview of some of the considerable material difficulties with which the blossoming scientific life of the D.R.V. must contend, I will return to the existence theorem announced a little while ago and, after all is said and done, proved by our Vietnamese colleagues: i.e., that there is a scientific life, and more particularly a mathematical life, in the D.R.V. I found an excellent spirit among all of the young mathematicians with whom I had the opportunity to talk — a great desire to improve their knowledge and to be able to engage in useful research on their own. Several of those whose interests are not too far removed from my own area of competence gave me the impression of having serious talent for research.

Thus, Đoàn Quỳnh, 33 years old, who was the translator for my talks, had spent

six years studying in the U.S.S.R. Being insufficiently well oriented themselves, his Vietnamese superiors arranged for him to work under the guidance of a Soviet mathematician specializing in old-style differential geometry who had never heard of the work of Chern. It was out of the question to change advisors, and so it was only after returning from the U.S.S.R. that Quỳnh was able to start, in almost complete isolation, studying what he correctly saw to be truly essential in the branch of mathematics that had been assigned to him: the theory of Lie groups and Lie algebras of Riemannian symmetric spaces, and their topology. Before the escalation he published a short paper in *Doklady* on the cohomology of certain homogeneous spaces of compact Lie groups, and very recently he wrote a research paper giving some new Riemannian homogeneous spaces of positive curvature. This article is soon to appear in Vietnamese. I passed on to Berger, who is a specialist, a note for *Comptes Rendus* submitted by Quỳnh, and I understand that Berger thinks that the announced results are interesting and plausible. He assured me that he would contact Quỳnh in order to get the details of the proofs and discuss with him certain questions suggested by the note.

Another mathematician by the name of Hào, 28 years old, studied discrete groups with Kurosh, and wrote a Candidate's dissertation on different transfinite definitions of the notion of nilpotence and solvability in such groups. He also published results on this question during the escalation. He has read the fundamental article of Chevalley in the *Tohoku Math. Journal* on finite groups associated to complex semisimple Lie groups; he would like to enlarge his sphere of knowledge, and is especially interested in profinite groups. He also made an excellent impression on me.

Of the "algebraists" I talked with, these are the two whose knowledge seemed to me to be most solidly grounded, and they are probably among the most talented. I also talked to younger instructors, some of whom would like to work in homological algebra but clearly lacked the background to begin.

At present, among our colleagues in the D.R.V., one finds active mathematicians in

branches of mathematics that are very diverse and of unequal importance, for example:

— Theory of probability.

— Numerical analysis.

— Logic, programming.

— Ordinary and partial differential equations.

— Functional analysis.

— General topology (a student of Smirnov), non-Euclidean geometry.

— Algebra (group theory, homological algebra).

— Differential geometry.

— Number theory (a student of Gel'fond).

— Functions of a real variable.

— Functions of a complex variable.

Our Vietnamese friends, and especially the senior mathematicians with whom I spoke, are well aware of the disadvantage of such a scattering of forces, as a result of which, except for some analysts who have succeeded in finding areas of common interest, each mathematician is isolated from the others and has essentially no opportunity for true scientific contact either within the country or, until the present, with other countries (except while actually studying abroad). They agree with me that it would be better if the mathematicians grouped themselves around certain key themes of modern mathematics, one of which might be algebraic geometry, another topology (in addition to analysis). But for developed mathematicians this would demand an effort of readjustment which only the best would be willing and able to undertake. So it is necessary for such a crystallization of interests to occur gradually, starting with the young mathematicians still being formed (of whom the best are still educated abroad, as a rule). In any case, it seems clear to me that this matter of regrouping is essential if the qualitative development of mathematical life in the D.R.V. is to match the extraordinary quantitative level of performance of our Vietnamese friends. This is certainly a difficult problem, in view of the very harsh general

circumstances created by the war, on the one hand, and, on the other hand, the force of inertia that a current state of affairs always has, even when one has a clear consciousness of the problems caused by that state of affairs. However, after all that I saw in the D.R.V., I believe that we can have confidence in our Vietnamese friends, and it would not be surprising if, in the coming ten or fifteen years, we saw a veritable blossoming of the scientific life of Vietnam, which we now see subsisting in the shadows.

V. I would like to say a few words about my impressions of the general atmosphere at the University, especially among the mathematicians. On a personal level, the atmosphere always seemed to me to be cordial and informal. The rapport between my Vietnamese colleagues and myself was established quickly and smoothly, confirming yet again the verity that, when two mathematicians from anywhere in the world get together, they start talking mathematics and immediately understand one another. I never once noticed any trace of xenophobia, neither toward the French nor the Americans, despite the excesses committed by the enemy forces (Japanese, French, American,...) and deeply felt by everyone over a thirty-year period.

Although the authority of the various officials in the university structure is beyond doubt, and there is an undeniable tendency toward centralized control in scientific life, as elsewhere, the relations between the higher-ups (ministers, the rector, department chairs, full professors) and the ordinary instructors are simple and direct. There do not seem to be very serious differences in salary and living standard between them: the salary of an assistant is 80 đòngs per month (about 8000 francs[4]), of which a person needs 20 đòngs to eat, while Hồ Chí Minh receives 250 đòngs.

Vietnamese officials gave the impression of being open-minded and rather knowledgeable about the general conditions that are necessary for scientific research. On several

[4] About US$16 in 1967. Both the exchange rates on Vietnamese currency and on French francs have changed by large factors since 1967. (*Editor's note.*)

occasions I had the opportunity to meet with Tạ Quang Bửu , the Minister of Higher Education and Technology, who is himself a mathematician, as I mentioned before. He is a person who struck me as remarkably intelligent, cultured and well-informed. Although essentially self-educated in mathematics, he is undoubtedly one of the Vietnamese having the most varied and solid grasp of mathematical culture, ranging from functional analysis to Turing machines. Before assuming his current post, for several years he had a position in the Mathematics Faculty. Despite his busy schedule, and undoubtedly in part in order to set an example, he attended all of the lectures I gave during the first week, when we were in Hanoi, and he was one of the few listeners who made their presence known through occasional questions. Incidentally, let me mention that it is well known among the Vietnamese that Phạm Văn Đồng, after he was already Prime Minister, took a night course at the Hanoi Polytechnic Institute for a year or two, despite his tasks at that time, which were certainly formidable.

At the beginning of my visit I was received by Phạm Văn Đồng, along with Tạ Quang Bửu and two other officials from the Pedagogical Institute and the University. At this time they all assured me of their agreement in principle to send young mathematicians to France to study algebraic geometry under my direction, if during my stay I met young people who were capable of profiting from such a visit. In general, I can attest that both the political leaders and the senior academic people are convinced that scientific research — including theoretical research having no immediate practical applications — is not a luxury, and that it is necessary to promote theoretical scientific research (as well as the development of instruction and the applied sciences) starting now, without waiting for a better future.

In their desire to succeed at original research, our Vietnamese friends thus certainly have the overall support of their leaders and university administrators. Unfortunately, those officials cannot control the very hard material conditions created by the war. On the other hand, and undoubtedly independently of the war conditions, they are not the only ones capable of making their views felt. It seems to me that in the party-based

organizations, whose officials often have only a vague idea of the conditions necessary for the development of original scientific thought, there is much less understanding of this subject. And the style of work and general ambiance seem to depend more upon the latter group than on the leaders themselves. For example, I observed that solitary contemplative work, as opposed to collective work, is considered to be in poor taste by a certain segment of the university community, which appears to be unaware that there can be no original thought without reflection in solitude. By the same token, and in the same direction, there is a tendency to judge the value of a seminar according to the number of participants. This has the effect of discouraging well-intentioned young people from organizing a seminar on a difficult subject that requires a really serious intellectual effort, since in the present circumstances such a seminar will have only a very small number of participants. One must keep in mind the very different conditions of work of our Vietnamese colleagues, under which a seminar can never be a purely personal undertaking of two or three people (there is no such thing as a purely personal undertaking in the D.R.V. in the present conditions!), but rather must of necessity have official approval; and a seminar that is numerically very small risks being regarded as unjustified. There is a clear conflict here between the requirements of quantity and quality, which in the case of creative thought are most often in contradiction to one another. We have to hope that the confusion among some political officials concerning the two types of requirements is a passing phenomenon which will diminish as the general cultural level rises. For the time being it adds to the other, already extremely serious handicaps which must be overcome by the mathematicians of the D.R.V. in order to do good research. The fact that, despite all this, some of them have succeeded in doing useful research, should be one reason more for us to have confidence in them and to do our best to assist them in their difficult task.

VI. I have come to perhaps the most important part of this talk: is there a real possibility for us to help our friends in the Vietnamese universities, and, if so, in what

way? Concerning the first question, there is no doubt in my mind that the answer is certainly yes. The project that was initiated last spring of sending books to the University (or, better yet, to both the University and the Pedagogical Institute), is certainly of benefit to them. Except for some old books generally dating to the French occupation, the Hanoi University library contains mainly Russian and Chinese books, very few from western countries. They are unaware even of the existence of certain books which we consider to be basic texts (an example: Helgason's book on Riemannian symmetric spaces). For our friends in the D.R.V. whatever aid we can send them is, from a psychological point of view, a form of encouragement which should not be underestimated. Moreover, the books can effectively serve as extremely useful tools for their work which they would not otherwise be in a position to obtain.

It must be said that books will be useful to them only to the extent that they reach a certain stage of awareness of the existence and the contents of such-and-such a book. For this reason, I believe that the most urgent manner in which we must assist our mathematician friends in the D.R.V. is to help them orient themselves in mathematics, by using all the means at our disposal (letters and visits) to put ourselves in and remain in contact with them. My impression is that it is the lack of contact with the outside which is the principal handicap among all of the numerous difficulties that they must face. In fact, it seems that even those who return from the U.S.S.R., for example, do not dare hope to remain in written contact with their former advisors. I have the impression that this is due more to timidity on the part of the student toward the advisor than to any implicit or explicit restriction by the authorities concerning scientific correspondence with other countries.

In any case, during my stay in the D.R.V. I did not miss any opportunity to encourage my various acquaintances not to hesitate to write to me or to any other mathematician who they think might be capable of answering any question they might have (of a technical nature, or concerning their general orientation), and I assured them that I was convinced

that my colleagues, as much as myself, would consider it their duty to respond to any such letter that was written to them. Several of them, in turn, promised me that they would write me in case of need. They understand that if I myself am not competent to reply, then I will pass on the letter to the mathematician who seems to me to be most capable of responding. As for visits by foreign mathematicians to the D.R.V., as I said before, one cannot count on many in the immediate future, because of the intensification of the bombing since October and the further intensification expected to come. It would be logistically easier, and undoubtedly much more useful, for us to invite some of our mathematical colleagues from Vietnam. Although over the past ten years there has not been any young Vietnamese mathematician or student of mathematics sent to a capitalist country for study or consultations, the principal officials, as I mentioned before, told me that they are favorably inclined toward this as a possibility for the near future. They gave me the authorization to submit a list of three mathematicians who seemed to me to be the most talented among those wanting to work in algebraic geometry. This list consists of Quỳnh, Hào and Sính, of whom I have already had occasion to speak. I proposed that they be sent to France to work with me for three or four years, time enough to learn the subject and write a good thesis, so that when they return to the D.R.V. they can form the core of a future school of algebraic geometers in the D.R.V. This would be a truly effective first step in counteracting the scattering of their mathematicians throughout a multitude of subjects, some of secondary importance — a situation which our friends in the D.R.V. themselves deplore. There should not be any difficulty from a financial point of view, since the French Cultural Attaché in Hanoi, Monsieur Le Guern, assured me that at present the government of the D.R.V. is far from having taken advantage of all of the fellowships which the French government is prepared to grant to Vietnamese scientists.

VII. I would like also to add a few words about my extremely warm reception by everyone I had the occasion to meet during my entire stay in the D.R.V. There was no

personal contact which I had there which did not leave me with a memory of warmth and good will — this included our colleages at Hanoi University and the two Pedagogical Institutes, the cultural relations officials in Hanoi, the "guardian angel" by the name of Liên who was assigned to me by the State Science Committee, the cook Bác Thị ("uncle Thị") whom I drove to despair because of the underemployment in which my frugal tastes kept him, and many others. In the rather exceptional circumstances into which my visit inserted itself, this reception contributed to making my stay in Vietnam an extremely memorable and enriching experience.

VIII. Of the many impressions which I brought back from my visit to the D.R.V., perhaps the most striking is the calm confidence in the future which I noticed among everyone with whom I had occasion to speak. It is quite clear that this confidence is not a façade displayed to foreigners or to one another, but rather a deep and very genuine feeling which is rooted in the thirty years of struggle of the Vietnamese people to achieve independence and construct a new society. It has not been diminished — quite the contrary — by the fact that the country's towns and industrial installations have been largely destroyed during the escalation of the war by the Americans. Experience has shown them that one can continue to lead a decent and socially useful life under such conditions, and that one can begin to prepare for peacetime during the height of the war, even if the war is going to have to last another ten years (an eventuality which is accepted as a definite possibility in the official propaganda of the D.R.V.). Our Vietnamese friends in all professions and at all levels of responsibility are convinced that a country's only truly essential wealth is found in the quality of its citizens. And through an effort undoubtedly without precedent in history, in spite of everything they are succeeding in increasing the cultural and professional level of their citizens, even as their country is to a great extent being devastated by the largest industrial power in the world. They know that, once the war ends, there will be people with the professional and moral qualities needed to

reconstruct the country, most of whom will have been educated and tested under the anti-personnel bombs dropped by the Americans. They have confidence in themselves, and that is the best reason for us to have confidence in them and in their struggle on all fronts, cultural as well as economic and military.

Translated from the French by Neal Koblitz