

## International Scientific Communication in Industry: Some General Considerations\*

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In considering how to make a contribution to this symposium, and specifically my own subject, I pondered over the meaning of each word in the title. I then considered the approaches which the other contributors have taken. In doing this, I shall draw upon a brief presentation which was made in September, 1954, to an American Chemical Society meeting in New York City. I feel I can do this for several reasons: first, the paper was never published; second, it was viewed at the time as being light in material content; third, it did not fit the mechanistic views of most of the participants, and fourth, I was the author.

Drawing from this paper, I found that, we were discussing information collection, which is not very different from communication. And the problem as it was deduced was stated as follows: "Information has to be observed reliably and reproducibly to be considered scientific, it has to be recorded in a way which is meaningful to other people, it has to be communicated and transmitted." All of these functions require individuals. Thus, in approaching today's subject, I find that we can restate it in these terms and we can now move on from this restatement to consider the factors which are germane.

The first of these will be the art of *communication* itself. You will note from the titles of the various symposia that are being presented in this meeting, before the Division of Chemical Literature, a splendid summary of the usual devices. I will select only a few phrases from these titles to indicate what I mean—they will give the flavor: "training of literature chemists," "generic searching," "clinical data processing," "deep indexing." In using these terms I am not being deprecatory; I am merely indicating the nature of the standard and rather obvious devices which are available. Why are they so much talked about and why are they so often developed in industry at great expense? I think part of the reason is that they are easy to do. It is easy to define most of the items that are being catalogued and about which information is encoded and decoded. The systems are easy to administer in the sense that they are specific. But are they really adequate?

I shall develop before this talk is over my point, which concerns a more satisfactory device, equally obvious, but one which is much harder to construct, administer or define, and that is personal relationship. A

rather extreme view of this point was made in 1954, and I quote it:

"Most information research depends upon someone's memory, more than any other one thing. All the indexes in the world are of no value if someone doesn't recall how the rules were formulated, or how to use them. The indexes in turn are much less useful than a personal call to someone who keeps bibliographies of certain subjects, and can recall from memory what he has seen and where to locate it. I suggest that the most fruitful research for the future is to get people with eidetic, *i.e.*, photographic, memories and train them as storehouses of information that can be recalled with a key work; a human's association is much better than a machine's, for a man can correlate more complex information at a faster speed than any machine.

"On a recent project we relied on triggering a person's memory with a key word or phrase from an inquirer. The person then went to the files where he remembered having indexed the information under language interpretations. Basically, the greatest storehouse is the written file card, of course, because people cannot retain details, but the location of that card is still a human function."

Let us pass on now to the question of whether international aspects are of special importance in our consideration. In analyzing this point, I shall touch on a number of items which are, perhaps, equally important in the national field. But it is constructive to analyze the problem from the international view because the difficulties in communication may be more obvious there. There are at least three very significant things that come immediately to mind, and then there is a group which is somewhat less often recognized. The three to which I refer are *time*, *distance*, and *language*.

*Time* is a problem in the sense that recent technology would indicate that the earth rotates—meaning that all parts of the globe are not simultaneously in the same time zone. The problem is worth mentioning only because our various devices for communication, notably the telephone and the mail system and perhaps ultimately television, have yet to overcome a real inertia, not to neglect inconvenience, which the mere effort of trying to get in touch with someone imposes.

The problem of *distance* is also mixed up with this and, while great strides obviously have been made in jet transportation and air mail, it would be my observation that we have yet to overcome distance. I would submit

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that the ease of communication drops off very fast with the distance. This is, I think, as much a mental barrier as anything because I can observe this impediment between two laboratories in Cambridge, and the difference between this situation and that of two laboratories in Chicago and Cambridge is not great; thus the distance problem in the international scene is hardly more than it is on the national scene.

As for *language*, we have a real barrier. Although in science we are speaking perhaps in terms which are international, as the science becomes less basic and more applied the language barrier will certainly increase. The fact that English is so often the universal language in these communications is, of course, a help to us, but where one encounters a real language barrier is between Russian and English or Japanese and English. I must admit the mechanics of handling the communication become quite significant and really justify the effort on translation by machines; the humor that sometimes results from their output is refreshing.

I would say that time, distance and language, therefore, are very significant, that they are almost inevitable, that devices can be found which will help us, but that the ultimate solution may come back again to an individual who takes the time to make the visit and who has the ability over language to communicate.

Let us move on now to some of the less obvious factors. I say less obvious because I think they are less often discussed. I begin with one which I think you may immediately challenge, and that is *economics*. I do so, not because this is a great discovery in industrial research but because of an angle it brings to bear on some of the later points. If our subject today is industry, as the title states, then we have to consider the economic motivation. Presumably industry desires to make money. It, therefore, retains some proprietary position on its information. This must then tend to inhibit the freedom of exchange. It can in fact lead to an attitude abroad that American communicators are actually industrial spies, and I believe the response at the end of the last war to the government teams, who quite properly made it a point to learn all they could of enemy technology, was to make later communication of a more open nature more difficult.

There was another economic point, too, and this was the belief that it was perhaps cheaper to do scientifically motivated research abroad than it was in the United States. I believe it can still be demonstrated that this is so, particularly at the basic level. However, the trends in recent years, particularly with the establishing of the European Common Market and the attendant burgeoning of the economy of Western Europe and other parts of the world as well, are eliminating this differential. In fact, from our vantage point we now find increasing interest on the part of foreign industrialists to make use of our talents in reverse.

A second point about the relationship revolves around *culture*. This is certainly a basic point in a human relationship on any subject. The culture of the next village may be so different from ours that we find it difficult to deal with each other. I believe the times are correcting the situation. There is now so much interchange through all kinds of public media that the barriers of culture are breaking down. Nevertheless, it is interesting to note that

the major research laboratories in Europe which have been sponsored by or derived their origin from the United States, including our own in Edinburgh, are staffed completely with Europeans. I submit that this is not because Americans do not have anything to contribute or are in effect scientifically inferior, but merely because the success of these laboratories depends so much on their cultural identification with the national scene in which they find themselves. It is easier for them to deal locally, but probably more difficult for them to deal with their original American sponsors.

An additional point, which borders on this and economics, concerns the difference in goals. If we are talking basic knowledge or science in the purest sense, I suspect there is no real difference in goals—so this angle would not be important; but as one approaches a consumer product or process of industrial importance, the difference between the goals may stand in the way or, conversely, it may be that the product of science will not be used by the culture that developed it. I think the exploitation of the Ziegler process in the United States would be a case in point. Here again, the trend is toward a more unified economic and cultural picture and this should, therefore, make the communication easier.

There is an added aspect of culture, and this is the attitude of the sciences toward the academic. It is well recognized that in the United States the involvement of university professors with industrial companies on a consulting basis is far advanced, probably to the greater advantage of both. In fact, it may some day be recognized that the same work goes on in industry and in the university although the motives may be quite different. Again, from my own observation, I believe that as far as content goes the work could have been done in either place but the attitude and the cultural reward would be diametrically opposed. When one goes to the international scene, I think one will find a considerable difference here. The connection between the industrial and university worlds is not as well established. Communication is, therefore, much less and it will create for us real problems if we are trying to communicate from this country.

A third social aspect to go along with economics and culture is *organization*. I think there are two points to be made about this. There has been a strong tendency, particularly in the last several decades in the United States, to bring into top management decision-making a representative of the technical area. In some companies this has gone all the way and the top management has itself originated in science. This is sometimes less desirable perhaps than might be assumed by this audience, but the point for us here is that communication within a corporation at these upper levels can be greatly improved thereby. In dealing with companies abroad, one does not find such representation to this degree. Thus, for the industrial side of the discussion it is a factor; on the academic side, it would not be important.

A second point on organization revolves around the formality with which the work is done. My own impression is that in the United States, except in the very largest companies where perhaps governmental work is at a high level, there is an unstructured kind of communication possible. In fact, there are definite rewards for being willing to break away from organization and structure if

necessary. Examples can often be found of individuals who believe so strongly in a technical advance that they risk being martyrs to accomplish the communication. This, by its very nature, becomes almost impossible in dealing internationally. It is all bound up with distance, the frequency of personal contact and the cultural differences already noted.

Let us turn now to *expertise*. If our study were pure science or the acquisition of knowledge, then there is no problem here at all. But as one's work becomes more applied, seeking closer contact with commercial ends, running into the need for industrial security or getting a head start in a new field, there will, by the very nature of things, be impediments raised for communication. Moreover, if each company, each region, each country begins to introduce into the problem its own lingo, its own materials, its own economics and its own processes, with each introduction it becomes more and more difficult not only to recognize what should be communicated and what should not, but to convey the complexity even with the best mechanical machinery through the barriers of time, distance and language. I submit again that the best solution must be the personal contact of the appropriate individual.

Finally, I touch upon *security* as a factor in the problem. On the one hand, we have national needs which lead to classification although I think less so now of truly basic governmental work; this policy raises all kinds of mechanical red tape which can discourage anyone. There is also the industrial classification problem which we have touched upon already. How is the company to share information and therefore to obtain information in return while at the same time maintaining its lead in profit? In looking at the program of the other members of today's panel, we can see that the next speaker will bring forth two very worthwhile approaches which are particularly pertinent to the industrial scene: The use of a technical representative, a single individual of high competence to

convey meaningful intelligence to a company's commercial and technical executives; this situation I would concur in as being most reasonable.

His second recommendation is the establishment abroad of a research institute which can become "an accepted member of the intimate scientific circles of the host country." I am sure I would concur in this approach also and, in fact, we have put it to demonstrated success. But it depends so much upon a resolution of this matter of security.

Some of the other speakers will address themselves to the vehicles by which communication is supported through the government and I view this as highly appropriate particularly in basic work. The increasing trend for the government to be the major supporter of these fields more than justifies the expenditures. It also provides the kind of control over national security which appears to be an inevitable and necessary factor.

I should like to mention one last point on our own experience in dealing with companies within the American economy. All mechanical devices are used, but there is no best way in our experience; there are all sorts of ways. What may be suited in one case would not be in another. So much of it depends upon the motives, the attitudes, the driving force, the needs for recognition and reward; and all of these lead in the end to people. I submit that the problems here are no different on the national scene than the international scene and that they are not different in science than they are in finance or sales or some other function, and that industry is industry and is similarly motivated on both sides of national boundaries.

I hope I have succeeded in accomplishing what I set out to do, which was to analyze the four significant words in the title. I hope you will concur with me that the key to the situation will rest with appropriate individuals who must take the time for and possess the personal skill to establish the bridge.