

3 EST in theory and practice

Over the past few years two developments have been apparent in the methodology of English teaching. One of these has been an increased concern with the problems of learners in further and higher education who need to know the language to pursue their specialist studies, in particular in the fields of science and technology. The second has been the recognition, provoked by recent work in sociolinguistics and philosophy, that the ability to use the language as a means of communication does not follow as a necessary consequence of learning the language as a formal system but has to be developed by teaching in some way. One development has extended from ELT to ESP/EST and the other has extended from linguistic structures to communicative activities. The developments are not, of course, unconnected. When English is taught in the context of general primary and secondary education there is no immediate means of checking on the assumption that communicative abilities will naturally emerge from a knowledge of the language system when the need arises. Aims are defined internally by reference to examination requirements. When aims are defined externally by reference to specific purposes, however, as they are in ESP/EST, an immediate return on teaching investment is expected in the form of effective communicative ability. A concern with ESP/EST necessarily entails a concern with communicative competence.

I do not think that it will be seriously disputed that there is a need to devise teaching programmes which will develop the communicative ability to handle scientific and technical discourse in English. The question at issue is how we might set about doing it and in this paper I want to explore this question and try to make clear in my own mind what problems are involved. The exploration will be tentative because I am uncertain of the ground and there are no reliable maps to guide us. I shall be feeling my way.

I will begin with a general observation and then explore its implications in detail. It seems to me that there are currently two ways of thinking about EST. One of them would appear to take the view that we already have the means of devising EST programmes and that our problems are essentially operational ones within the scope of pedagogy involving the appropriate application of what we already know. On the other hand there

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is an opposing school of thought which takes the view that we have very little to apply, that we know little or nothing about the nature of scientific and technical communication, and that the design of effective teaching programmes depends on the findings of research which has yet to be undertaken. In this view, the problems are essentially theoretical and come within the compass of linguistics broadly defined. My own feeling is that the first school of thought over-simplifies the situation and that the second over-complicates it. In this paper I should like to try to give substance to this feeling and thereby to work my way towards a formulation of what I see to be the principal problems in EST. In doing so I shall be trying to reconcile the operational and theoretical views, to mediate between pedagogy and linguistic theory in a broad sense. This paper is intended, therefore, as an exercise in applied linguistics.

I think that those who take the operational view believe that scientific and technical English can be characterized and taught as a register or group of related registers defined in terms of formal linguistic properties. To devise an EST programme, therefore, one would proceed in the following way: conduct a statistical survey on a sample of English of the kind one wishes to teach and establish the relative frequency of occurrence of the lexical and syntactic units in it, then devise language teaching materials which will give relative weighting to these linguistic elements in accordance with their importance as measured by frequency. This, of course, is one of the basic procedures employed for selection in structural syllabuses of the conventional kind. In this view, EST simply involves the application of an already existing approach to a more restricted sample of language data. Presentation as well as preparation procedures are also conceived in conventional terms and in good deal of existing EST material we find structural exercises and comprehension questions which only differ from those in general ELT material by being associated with language data which is scientific and technical in referential content.

I have expressed elsewhere my doubts about the efficacy of the structural approach in general and about its appropriateness for the teaching of science and technology in particular (Widdowson 1968). Perhaps I might briefly summarize my position here. A register analysis, as generally understood and practised, takes samples of actual discourse and breaks them down into their constituent linguistic elements. What counts as a linguistic element for the purpose of the analysis will be determined by the model of description being used and the largely *ad hoc* decision as to which elements are likely to be easiest to recognize and count and which are likely to yield a significant characterization of the sample. A taxonomic model, for example, will reveal no deep structure elements; inter-sentential relations involving cross-reference might be significant but difficult to recognize and count; certain forms (*on, by, to*, for example)

would be easy to recognize and count but carry little information in isolation from the syntactic environments which indicate their functional significance. But quite apart from these design faults there is the more radical question of the nature of the information that emerges from this kind of formal analysis. What we get is a quantitative statement about the frequency and types of those linguistic elements which are specified in the model of analysis. Since the analysis isolates these from context it cannot indicate how they function in relation to each other in the discourse as a whole. It may reveal the relative frequency of tokens of certain clause types, for example, but it cannot indicate any variability in their communicative value; it may reveal a high incidence of passive verb forms but it cannot indicate the different kinds of statement which these forms are used to make. In brief a register analysis which atomizes discourse into linguistic elements characterizes a sample of language quantitatively as a manifestation of the language system. What it does not do is to show how the language system is realized qualitatively in particular instances as communicative activity. It accounts for samples of language as instances of linguistic usage but not as instances of communicative use.

It is of course precisely the manifestation of the language system as usage which the structural approach as commonly practised in general ELT is primarily designed to teach. Thus the operational view which sees the problem of EST as having to do with the application of the findings of register analyses in effect does not recognize the connection between the two developments which I mentioned in the introductory paragraph. The transition from ELT to EST does not correspond with a transition from linguistic forms to communicative functions: the assumption is still that once the usage characteristic of scientific and technical English is learned then students will automatically know how the language is put to use in those communicative activities which characterize science and technology as fields of inquiry. I do not believe that this is so and it is for this reason that I think that the school of thought that holds such a view oversimplifies the situation. I do not believe that a knowledge of how English is used in scientific and technical communication can arise as a natural consequence from the learning of the sentence patterns and vocabulary which are manifested most frequently in samples of communication of this kind. We need to set up conditions which will lead students to make the transition from usage to use.

But if EST is to be concerned with the teaching of use where can we find descriptions of use upon which teaching programmes can be based? The short answer is: nowhere. At this point we come to the second school of thought. The view here might be expressed as follows: EST must be centrally concerned with developing the ability to process scientific and technical communication. This involves a recognition of how the concepts and procedures of science and technology are expressed through commu-

nicative acts which are related in an intricate way to form structured discourse and how this complex structure of acts is realized through the particular medium of English. In brief, the effective design of EST programmes is thought to depend on descriptions of use based on a comprehensive model of discourse. Whereas the operational view represents the task of teaching EST as straightforward and within the competence of the practising teacher, this view represents it as enormously complex: a matter for research in an area of inter-disciplinary inquiry which at present is the scene of a great deal of busy activity in the form of tentative exploration with everybody staking claims but where nothing is known with any certainty. A pioneer's delight but a nightmare for anyone with a liking for law and order.

It might be edifying to consider briefly the kind of difficulties which have arisen in this field of research. So long as the systematic study of language operates at a level of idealization which excludes variation and context, it is possible to specify the properties of a language in terms of well-defined linguistic units. But once this idealization is relaxed to allow consideration of the fact that people use language to communicate with each other in social settings, the ordered arrangement of this neat conceptual universe begins to disintegrate. Philosophers in their speculative way talk about speech acts and linguists, naturally inclined to value speculation, feel compelled to take note of how sentences are used in the performance of such acts. In consequence, certain basic distinctions lose their clarity. The classic dichotomies upon which so much of modern linguistics depends: *langue/parole*, competence/performance, sentence/utterance, semantics/pragmatics, are called into question. At the same time, the linguistic order is being undermined from another quarter: those scholars who adopt a sociological perspective on the study of language point to the regulatory of variation and its significance in accounting for social meaning. They show how the systematic study of actual language data can reveal system, that by widening the scope of linguistic inquiry one can establish regularity without having to postulate homogeneity, that system can be dynamic and variable and does not have to be static and well-defined.

It should not be supposed that the current uncertainty in linguistics betokens a decline. Theoretical principles must, like everything else, be subject to change. All systematic inquiry must be based on idealization of one sort or another, and idealization of one sort provides the opportunity of developing insights which are different from those which idealization of another sort might allow. The fact that linguistics is currently undergoing a reappraisal of its principles and a realignment of its theoretical position should not make us forget the immensely important advances which were made under the formalist, and more particularly, the transformational-generative régime. On the other hand it should

make us aware of two points which are of relevance to our discussion of EST.

The first relates to the operational school of thought which I spoke about earlier. It is this: there is no model of linguistic description that has a patent on the truth and so there is no model of linguistic description which should command complete allegiance. The language teacher necessarily looks to the linguist for guidance and it is obviously tempting to seek security in one view of language rather than to range restlessly over several. But it seems to me that the second alternative is the one that is to be preferred. The language teacher should be adept at drawing insights from a wide spectrum of inquiry and to exploit them for his own purposes in order to arrive at a synthesis based on pedagogic principles. Only if he has this flexibility will he be able to adjust to the kind of teaching needs which EST, for example, brings to light by taking new developments in linguistic thinking into account. As I have already suggested, the operational view is inadequate because it adheres too closely to a particular model of description.

The second point that arises in connection with the current state of linguistics relates to what I have called the theoretical view of EST. The problem here is that those who espouse it are in a sense too much involved in recent developments. Whereas the first view is not sufficiently informed by theory, the second is not sufficiently informed by practice. Let us consider this view more closely. In standard generative theory there is an assumption that the underlying cognitive processes which inform language behaviour can be captured by a set of algebraic rules: an equation is set up between linguistic description and linguistic knowledge and the term generative is used to refer both to the production of formal objects in a grammar and the production of mental constructs which are represented as underlying the utterance of pieces of language when the occasion for utterance arises. This equation is now being questioned. Sociolinguists in particular are saying that a good deal of what a speaker knows about his language cannot be incorporated into a generative grammar so that the linguistic description it presents cannot be equated with linguistic knowledge. The question is, of course, what kind of description *can* account for this knowledge? Is there any way of saving the equation? It is precisely this question which is exercising linguists at the moment and which lies behind their concern with illocutions, speech functions, presuppositions, text grammars, discourse analysis, and all the rest of it. It is a crucial question for the development of linguistics, but is it a crucial question for the development of language teaching, and in particular for the development of EST? The theoretical view believes that it is: that we cannot teach communicative competence, the ability to handle English use in discourse, until we have a description of it, that teachers cannot proceed to develop this knowledge in their students until the linguists

have described it for them. I myself believe that this view is wrong and that it over-complicates the issue. Moreover, I think that it shows just as mistaken a concept of the relationship between linguistics and language teaching as does the operational view.

So far I have done a good deal of criticizing, but I have now come to the point at which I must suggest an alternative way of looking at these matters: one which mediates between teaching and research and which brings developments in EST within the scope of practical methodology. The theoretical view is basically that we cannot effectively teach what we cannot explicitly describe and since we cannot describe the way English is used in scientific and technical discourse, our attention must be directed towards doing so as a preliminary to the design of EST programmes. This leaves the language teacher with nothing to do but to stand and wait. But although we are not in a position to describe discourse in a systematic way, the language user himself knows how to create and understand discourse of different kinds expressed in his own language. This knowledge has not been made explicit in exact descriptions of the kind the linguist would find satisfactory but do we so completely depend upon such a description for developing means of guiding students to an acquisition of this knowledge? I do not think so.

Let us consider what a practical knowledge of EST might involve. I think that the first point that has to be made is that EST is at one and the same time a variety of English usage and the particular linguistic realization of a mode of communicating which is neutral in respect to different languages. That is to say, EST does indeed manifest the system of English in a certain way but the significance of this is that it does so in the expression of concepts and procedures which characterize different technologies and scientific disciplines, and which might be said to constitute their basic communicative system. What I am suggesting, then, is that fields of inquiry in the physical and applied sciences, as these are generally understood, are defined by their communicative systems, which exist as a kind of cognitive deep structure independently of individual realizations in different languages. I think that this communicative deep structure frequently emerges on the surface as mathematical expressions, formulae, graphs, charts, conventionalized diagrams, and so on, which take the same form irrespective of the differences of the verbal context in which they occur. We can define scientific discourse, then, as the verbal and non-verbal realization of the communicative system of science. Now this system *has* been described under the name of the philosophy of science, and any systematic description of scientific discourse in English must therefore take account of this philosophy, which represents the basic principles of scientific inquiry. But does this mean that the teacher must also take account of it in his teaching of EST? This question worries many English teachers: they feel that they cannot possibly teach EST

because they are not scientists. It is a question, therefore, which we must consider carefully.

The philosophy or communicative system of a science defines that science as a discipline. The science teacher's task is to develop teaching techniques and materials which will guide his students to acquire a knowledge of this system. In other words, the principles of the discipline are pedagogically processed to fashion a subject for teaching. The teacher of EST is not generally called upon to teach the English discourse of science as a discipline, but the English discourse of science as a subject, as this has been designed through the pedagogy of science. It is not the English teacher's task to design science teaching programmes. He might find it of interest to investigate the philosophy of science as a discipline but what he needs to know something about is the pedagogy of science as a subject. The reason for this is that the closer the English teacher's methodology can be made to approximate to that of science teaching, the more successful he will be in integrating the two areas of knowledge whose synthesis constitutes relevant English use. I shall return to this point presently.

Meanwhile, let us consider the question of what is involved in a practical knowledge of EST. If what has been said in the preceding paragraph is accepted, it will be evident that what students need to know is how English is used to realize the discourse of that level of scientific instruction that they have arrived at. I have already suggested that the communicative systems of different scientific disciplines are independent of any particular linguistic realization. Can we also say that the pedagogic methodology associated with different scientific subjects is similarly universal? I think that perhaps we can. I think that it is likely that scientific textbooks written in different languages express essentially the same methodology. Moreover, as with the communicative system of the discipline, I think that this methodology is reflected in certain non-verbal devices of exposition which are common to all textbooks. Now if this is so, then students will have already acquired some knowledge of the communicative systems of science which appear, pedagogically processed, in scientific subjects. How much they know will depend on the stage they have reached in their studies, but they will know something. This knowledge may hitherto have been acquired only through their own language. The English teacher's task is not to develop this knowledge but to demonstrate how it is realized through the medium of a different language. How can this best be done?

The operational view would presumably be that we teach the vocabulary and structures which are manifested most commonly in English scientific discourse in general. The theoretical view would be that we must first describe and then teach how the communicative systems of the discipline in question are realized uniquely in English. Underlying both points of view are two assumptions, both of which seem to me to be

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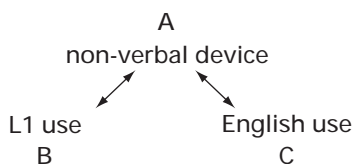
mistaken. First, it is assumed that the learner has little or no previous knowledge of how language is used in scientific communication. EST is represented as in some sense a separate learning task. The second assumption is that what is to be learnt has to be explicitly taught, that knowledge is a kind of model that has to be constructed in the learner's mind rather than a dynamic process which develops of itself. Here EST is represented as in some sense a complete and well-defined learning task. I think that both of these assumptions are wrong and misrepresent the kind of knowledge which students of EST must acquire.

Let us consider the case of a student who enters higher education to study a scientific or technical subject, and who has to read textbooks in English. In his secondary schooling he has, we will assume, acquired knowledge of two kinds. In the first place, he will have some knowledge of English usage, conveyed to him by means of a structural syllabus of the familiar kind. Secondly, he will have learnt some science and in consequence he will have some knowledge of how his own language is put to communicative use in scientific discourse of an instructional sort. This learning of science will, of course, have drawn upon the student's more general awareness of how his own language functions as communication. The situation is, then, that the student has some knowledge of English usage and some knowledge of how his own language is put to use in scientific discourse. The task for the teacher of EST is to relate these two kinds of knowledge, to convert usage into use by reference to the student's existing communicative competence in his own language. EST is best considered not as a separate operation but as a development from, or an alternative realization of, what has already been learnt, that is to say existing knowledge. Its first objective is to change the student's concept of English from that which represents it as a separate set of facts about words and sentence patterns and grammatical rules to that which represents it as a means of communication similar in nature to his own language. It is not easy to persuade a language learner to see a foreign language in this light in the context of general education since so many of the situations which are set up to give meaning to the language are obviously contrived for that sole purpose. In the context of EST, however, it is not difficult to convince the student of the communicative reality of the language. What the EST programme has to do is to show him how to cope with it.

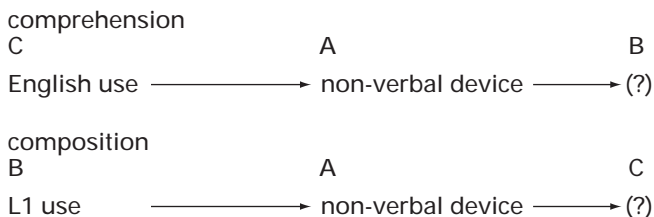
I have discussed elsewhere one way in which this might be done. It involves making use of those non-verbal devices which are, as I have already suggested, the universally conventionalized expression of the underlying communicative systems of science. Now since these non-verbal modes of communicating represent some of the basic concepts and procedures of different scientific subjects, they can serve as a point of reference for verbal realizations in the student's own language and in English.

What I am suggesting is a translation procedure but as a three-cornered operation. Translation, as it is commonly conceived, converts one structure into another which is thought to have the same meaning by virtue of the semantic equivalence of its linguistic elements. The use of non-verbal devices enables us to relate three ways of expressing the same basic concepts and procedures. In this way, the student can be shown in general how English is used in the same way as his own language and in particular how it is used in the performance of specific acts of communication relating to the communicative system of science. Thus a knowledge of EST can derive from what the student knows of science and the functioning of his own language in association with what he has learnt of English usage. This three-way translation procedure can be controlled for difficulty, as it must be of course if it is to function effectively as a teaching device.

Exercises of this three-way translation type can prepare the way for exercises in which the support of the student's own language is withdrawn and the relationship to be established is made directly between non-verbal representations and English use. In exercises of this information transfer type, we have two instances of English use related to the same type of non-verbal device. In the case of three-way translation, we have the following situations:

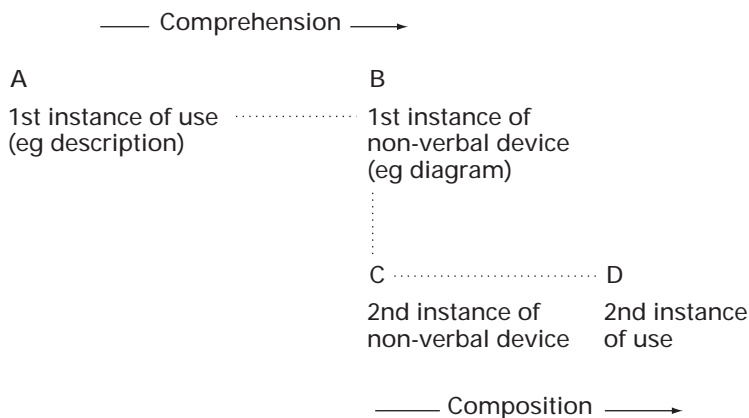


When the non-verbal device is given with the instance of English use, ($C \rightarrow A$) the provision of the translation is essentially a comprehension task. When the non-verbal device is given with the instance of L1 use ($B \rightarrow A$) then the provision of the translation is essentially a composition task. We might show this as follows:



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In the case of information transfer exercises, there are two instances of use again but both are in English, and we present two instances of non-verbal device of the same type. For example, we might give a brief description of an experiment, a mechanical device, a piece of equipment, and so on. This would be the first instance of use. We might then require the student to label a given diagram, or draw a diagram of his own which represented the facts of the description. This would be the first instance of a non-verbal device. The transfer here is essentially a comprehension task. Next we present a second diagram which represents the same kind of information (realizes the same type of concept or procedure) as the diagram that the student has already completed and we now require him to derive a description from it which will be correspondingly similar to the original description, which, of course, acts as a model for this second instance of use. The transfer from the second instance of verbal device to the second instance of use is essentially a composition task. We might represent the process of information transfer as follows:



The dotted lines in this scheme show where control can be applied. It can be applied between A and B by varying the degree of difficulty of the task the student has to undertake: he may be given a partially labelled diagram, or an unlabelled diagram, or an incomplete diagram, or no diagram at all. Control can also be applied between C and D in a similar way: the student might be given key words or phrases, or be asked to assemble an assortment of sentences into a well-formed discourse, or be given no help at all, except of course the possibility of referring to the first instance of use as a model. The control between B and C has to do with the degree of similarity that holds between the instances of non-

verbal device, and this will in turn determine the extent to which the first instance of use can be used as a model for the second.

I should like to make two points about the procedures that have been outlined and partially illustrated here. The first of them has to do with the comment I made earlier about the desirability of the English teacher knowing something about the methodology of science teaching. It is obviously central to the purpose of these exercises in mediated translation and information transfer that the language presented and produced should be instances of use and not instances of usage. The students must feel that they are involved in meaningful communicative activity and not just doing a language exercise. This means that the problems they have to solve should as far as possible make appeal to the kind of cognitive processes which it is the purpose of science teaching to develop. What this involves in general is an exploitation of science teaching methodology. The suggestions I have made give only a hint of how this might be done, but I believe that the teacher of EST would be best advised to seek methodological guidance not from the linguist or the philosopher of science but from the science teacher. His best source of reference is likely to be (at least in our present state of theoretical and descriptive uncertainty) textbooks of science and the experience of his science teaching colleagues. In short, it seems to me that if EST is to be concerned with the teaching of use, then it must be conducted not as a separate operation but as an extension from science education.

My second point relates to the second assumption that I referred to earlier, and here I move on to very uncertain ground with only my intuition to guide me. The exercises I have suggested do not direct the student's attention to features of language in any explicit way: they provide an opportunity for the student to induce meanings by reference to his own knowledge. The focus is on the communicative function of use and not on the linguistic forms of usage. The underlying assumption is that usage will come into focus, that is to say, will conform to norms of correctness, as a consequence of practice in appropriate use. This, of course, is the reverse of the commonly held view that correctness should be of primary concern. But I would like to take a more radical departure from established opinion. The exercises concentrate on use but they do not do so in any very exact way: the student is largely left to work things out for himself within the controlled specification of the problem. Now there is a good deal of talk these days in language teaching circles of the importance of teaching communicative competence and there is a general assumption that this competence can and should be described with the same degree of precision as linguistic competence is described in grammars as a preliminary to really effective teaching. It is this assumption that informs what I have called the

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theoretical approach to EST. Thus both the operational and the theoretical views suppose that precise description is a prerequisite for effective learning, that what is taught and learnt has to be specified in advance as a set of structures or lexical items or communicative acts which are, as it were, stored in the mind for use when required; that once these have been transferred to the store the learning task is done and the rest is a matter of applying this existing knowledge as the occasion arises. This view seems to me to be intuitively wrong. It does not seem to explain the way in which language users create discourse *extempore*, how they make sense of language use even when it does not conform to norms of correct usage. It does not seem to explain how language develops in the individual and changes in society. What we need, I think, to account for these phenomena is a model of use which deals not in precise rules but in more general strategies and which represents the communicative process not as a matter of correlating what one perceives with already acquired schemes of knowledge but as an 'ongoing accomplishment' (the term is Garfinkel's (see Turner 1974)) whereby one realizes as much meaning from instances of use as seems necessary for one's purposes.

What I am suggesting is that descriptions of use in terms of precise rules may give an inaccurate picture of how people use language, that accuracy cannot be achieved by exactness because exactness is not a feature of normal communication. This does not mean, of course, that it is not a valid research aim to devise means of describing use, but I believe that these means will not satisfactorily be found in the postulation of precise rules which will generate discourse structures in the same sort of way as sentences are generated by a grammar. Most linguists think of discourse analysis as an operation on existing data to discover patterns of form or function which can be reduced to rule. I would suggest that we are likely to arrive at a more convincing account of discourse by looking not at the finished object, a piece of existing text, but at the process which creates and interprets it by a combination of knowledge, imagination, reason, common sense, and other attributes of the human mind. I cannot help feeling, outrageous though the feeling might seem to be, that literary critics have come closer than linguists to an understanding of the communicative function of language and the ways in which discourse is made. Their approach to language acknowledges at least that meanings in discourse are to be worked out by active interpretation and are not a simple function of correlation, that this interpreting ability depends on more than just a knowledge of pre-formulated rules. The literary approach to discourse analysis is, in fact, not unlike that of the ethnomethodologists: both stress the elusiveness of exact meaning, the creative aspect of interpretation, the importance of involvement.

The concept of precision has, of course, been carried over from linguistics to language teaching. The teaching of the structural syllabus is generally carried out in a systematic step-by-step fashion with the intention that each linguistic unit should be thoroughly learnt before proceeding with the next, and there is a generous provision for repetition to ensure that it is. No allowance is made in the actual teaching, however, for the relative communicative value of these units as they occur in discourse, so that when it comes to reading comprehension, learners attempt to be too precise, to focus their attention myopically on the meaning of individual linguistic units. The practised reader, however, ranges selectively over discourse and draws from it just such meaning as will satisfy his expectations before he begins to read and the predictions which are set up as he reads. He develops a changing cognitive map, as it were, and takes note of what is of relevance to it and lets pass what is not, using his knowledge of the communicative system of different universes of discourse as a general prompt but not as a script. Many native speakers would fail miserably on comprehension tests of the conventional kind (unless they were given advance warning) because such tests require a close scrutiny of detail which the reader would not normally submit to what he reads, and which would, indeed, interfere with his normal reading process. Comprehension tests are often designed in such a way as to prevent rather than to develop an effective reading ability. They focus too much on detail; they are too precise.

These very tentative observations lead me to conclude that the description of discourse and the interpretative strategies of language users (whether they are applying these strategies in production or reception) should not be distinct. The task for theory and description is to devise a model of interpretation which will capture its systematic and *extempore* character and show how the static knowledge of rules is converted into communicative activity. I have no idea what a model of this kind would look like, but among current explorations into language use I suspect it would bear a closer resemblance to the work of ethnomethodologists and literary critics than to that of linguists.

Meanwhile, the language teacher does not have to wait for such a model to be devised. He can treat the kind of speculations I have presented here as initial hypotheses and develop teaching materials to test them for pedagogic potential. With regard to EST in particular he can devise exercises of the kind I have suggested which draw on the student's ability to interpret his own language as use and encourage him to apply the same process to English.

As time goes by, academic research will no doubt yield more insights about language use in discourse in general and about English use in particular. But the devotees of disciplines do not have a monopoly on research: it can also be done by practising teachers drawing their

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inspiration from ideas already in circulation. The development of EST depends on a reconciliation between the operational and theoretical views as I have described them, on a recognition that theory and practice in language teaching are aspects of the same single, if complex, activity.

Notes

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