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Riches, K.W.

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Some recent developments in AUTOMATED TEACHING

By K. W. A. RICHES

Shell International, London

THIS afternoon I would like to talk to you about the experiences that we have had within our organisation with programmed learning, teaching machines, language switchboards, etc. But I would ask you please to bear in mind that you are getting this from an industrial viewpoint and not an academic one.

I would like to break my talk down into a number of groups. The first group I would like to talk about is the language laboratory, or language switchboard. I won't go into that in too much detail, but I would like to discuss the audio-visual aids used in conjunction with the language switchboard. I will demonstrate some that I have brought with me. By audio-visual is meant the picture-word combination. I would also like to tell you about our use of case studies in teaching languages. The second thing I would like to go on to is the electronic ear which is probably quite an important recent development which may have a considerable effect on the methods of teaching languages. Thirdly I should like to talk to you about our experience with an adaptive type of teaching machine called "SAKI" which stands for "self-organising automatic keyboard instructor". I would then like to show you a programmed text-book which we have for our sales staff.

First of all, the language laboratory switchboards. Recently, the Duke of Edinburgh made a trip to South America and during a talk to business men there, he made a very pertinent remark. This is a talk to British business men. He said: "It is very much better to go in a bowler hat speaking Spanish than in a sombrero speaking English." This is something which we in Shell have tried to encourage amongst our international staff for some considerable time, but I must confess that some of the methods for learning or for teaching these languages have been somewhat archaic.

A short while ago in 1959, owing to a political crisis in Indonesia, we were faced with the problem of pulling out a large number of Dutch international staff and replacing them with international staff of other nationalities and this posed us a problem of the new staff knowing Bahasa Indonesia. How were we going to solve this problem? At that time one of our language trainers in the company produced some statistics. Now I know that we had a little discourse yesterday morning on the danger of statistics from Mr. Goodman. I think he said that you can prove anything you like with them. I am just about to prove something. From an academic point of view it may be exaggerated. If it is I apologise, but this is what this linguistic teacher of ours said: "In a certain school in a country unnamed, they were teaching French over a period of five years—an average of 40 weeks per year, an average of three hours per week, so if you take that as a simple mathematical calculation, you get $40 \times 3 \times 5 = 600$. Now proceeding from that point, there were 20 students in a classroom, so if we take 600 and divide that by 20, we get 30. Thirty what? Thirty hours per student maximum per year—over the period of five years. Now the teacher would spend roughly half his time talking, so out of the 30 hours, you are then left with 15 as far as the student is concerned, so that's 15 hours practice speaking French over a period of five years. Well, if you divide that by five, he speaks on an average three hours French per year". Although this may be exaggerated, there is an element of truth in it and we were faced with this problem of how to get these people to speak Bahasa Indonesia quickly, and this is when we went in for the language switchboard as it has commonly become known. Of course, language laboratories were operating before that in the United States. We started our language switchboard and by now about 300 people have gone through it, including not only the staff who have been transferred to Indonesia, but also their wives.

We run courses of one week's duration, two weeks, four weeks and six weeks, the length of courses depending on the number of people going and how soon they are going; in fact it invariably depends on how soon we can get the visa. Normally it takes four weeks to get a visa, so the courses are four weeks in duration. That is the governing factor. We run these courses of different types and different lengths. But one thing we think we do achieve is after a, say, two weeks' course, the student is familiar with about 450 words and

when he gets off the plane at Takata he is confident enough to speak Bahasa Indonesia and he is able to speak it reasonably well. He cannot, of course, read a newspaper. We aren't concentrating on that at all. We are after a purely automatic response without knowledge. There is no grammar coming into it at all. In order to help the student a little more, we produced a book called *Bahasa Indonesia*, which in a nutshell covers the course, but not in the way of a normal book. Shell South Africa have a copy of this book and if anybody is interested in seeing it, I am sure they will be only too happy to let you see it.

An interesting observation which our language teachers have made is that if, for instance, in one week students learn ×, in two weeks they learn 2× plus, but in four weeks 7 or 8×. Why this is, we are not sure. But this is what we have found out over a period of time. In other words, it is an accumulative process.

We get students into conversation within their first hour and a half of starting the course. We don't, of course, keep them in the kiosk in the language switchboard all day. They couldn't cope with it. They are in for periods of three quarters of an hour to an hour, perhaps for an hour and a quarter and then they come out and they may have a talk on the cultural background of Indonesia, or they may have a talk on some aspect of the language and then perhaps they go back again or they may do something else.

That is how we in Shell went into the language business, as you might say.

The cost of this equipment was about £1,300 which includes 12 booths and a console or a master set. In London, we run not only Indonesian on it, but also French and German. The Hague have been much more energetic than we have because they've tried Spanish, French, German, Japanese and Italian.

Before I leave this subject, I would like to mention one thing. We have a booklet called *The Language Switchboard* which is available free from Shell South Africa.

I brought with me a cutting from the *Financial Times* of April 6th, 1963, in which there is an article headed "Teach Yourself Indonesian in Two Weeks". It so happens that a reporter came along to Shell Centre and got the history of this venture of ours and has written it up. If you are interested, we have had thirty odd copies of that printed out here and if any delegates would like a copy afterwards, please help yourself.

I'd like to proceed now, still on the same point, language laboratory switchboards, but to the second aspect of it, the audio-visual aspect. We also have a number of language switchboards in Venezuela and there they have considerable experience in teaching English and Spanish. They have produced at practically no cost at all to themselves, a tape which I will put on in a little while to demonstrate to you, together with a film strip which you can show with an overhead projector of this type. Now if you don't have expensive equipment like that you can make these things singly in slides and use an ordinary slide projector, but I'll show you some of these in a moment. The object of this is to assist in the language laboratory work. The student still works in the laboratory, but when he is out of the laboratory, he may be in an exercise of this nature. The pauses that you notice on the tape between one question and the next are for students to repeat what they have heard and very often the teacher will go back again if they haven't got it correctly and go through it again, so it may take some time to get through a lesson and there is a whole series of this type of lesson which was designed by our own language people in Venezuela, this particular one for teaching local supervisors, Spanish-speaking supervisors, English. So that is really an example of an audio-visual additional adjunct to the language switchboard. This is a very unsophisticated one.

The French are very advanced in this field. You can get a complete course in the French language, the total cost of which is about £180 and it's a sixty to ninety hour course. It may be worth while if you are interested in this sort of thing to get a copy anyway of their teacher's manual for the course which is only 24/–. It will show you how they prepare the images with what is on the tape. There is no English in the case of the French used at all. It is pure memory and hearing as far as the student is concerned.

A colleague of mine was in the Congo about three weeks ago and there he found that the wives of foreigners living in the Congo were in fact receiving this type of training in teaching French so that they in their spare time could teach French to the Congolese. This was being done very cheaply and with considerable success.

The next point I'd like to cover is the use of case studies that we have used in language teaching. I've got one or two notes here on the advantages of this. This again started in Venezuela and our language people there hit upon this idea and these are some of the advantages that they found in using case studies for teaching language to supervisors in the middle supervisory grades. They said that the interest which the students develop in discussing the situations presented in the cases causes them to forget their embarrassment and anxiety about speaking a foreign language.

Both teachers and those who have learned a foreign language will agree that when the desire to express their views becomes more important than the fear of making mistakes, the battle is more than half won. The students have to make their knowledge of the language fit the situation. This is a very different process of course from the normal conversation practice where the student develops a conversation to fit the knowledge that he has got of the language. It also provides a positive stimulus to enlarging vocabulary and certainly contributes to improving the capacity to think in a foreign language.

A further advantage of the interest this method arouses is the way in which it strengthens the student's motivation and determination to learn. Well, these were some of the advantages that they found by using cases in conjunction with the Tutadicta or the language switchboard, in conjunction with the audio-visual technique that you have just seen. So they are using all three on the same programme and for the same people.

Before I leave the subject of language switchboards, if any delegate is visiting Cape Town, he or she would be most welcome to visit Lloyd House which is Shell Training Centre there, to view our language equipment and also to watch a course in progress. The next course is programmed for June and thereafter in August, September and mid-October. So if anybody is interested, would they please make an arrangement with the Training Manager at Lloyd House, P.O. Box 19, Muizenberg. The Training Manager is a Mr. L. C. Masterson, who is here attending this conference, so you can probably see him if you don't wish to write to him.

Now I would like to go on to my second point, the electronic ear. This is a French invention developed by a Dr. Tomatis and he is using this machine clinically in Paris for people with speech disorders. On the other hand it is also being used by a Mr. Metais for language laboratory instruction. Metais is the language director of a group of schools in Paris and he also has something to do with a company which is making these machines called electronic ears which I will describe to you in a moment. Metais was recently at a conference in Antwerp at the International Audio-Visual Technical Centre where he demonstrated the use of this electronic ear. We managed to get hold of him and got him to bring his electronic ear to London for one afternoon and he gave us an exhibition of this in Shell Centre about two or three weeks ago. I also made a few enquiries as to who Mr. Metais might be and I found that he was Director of the Centre of Cybernetic Pedagogy, Director of Linguistics of the Language Centre, Paris, Deputy Chairman for the Association of Cybernetics Pedagogy; he is on the board of the National Union of Language Teachers, he is on the board of Automatic Translation and Applied Linguistics; he is secretary to the committee for the electro-acoustic analysis of speech.

He came over and brought his machine with him and we managed to get together a group of people in the United Kingdom who are interested in programmed learning, teaching machines and language laboratories or switchboards and he gave this group, of which I was a member, a discourse on this machine.

The equipment consists of a microphone, a box a little bit bigger than this and earphones; the student talks into the microphone, his voice goes through the magic box and he hears himself through the earphone. Now what is Metais, or Tomatis trying to do with this? Metais was talking about quantifying the linguistic approach. He was talking in terms of mathematical and statistical linguistics. He didn't go very deeply into this subject because, as he said, there is insufficient scientific data on this type of thing, but he himself has had 200 individual students to practise and go through courses at this machine, so he was talking from a certain amount of experience. I know I am on dangerous ground here, but I will risk it. I am telling you what Metais said. He made the point that, as far as normal speech is concerned, there is a subject, the person speaks about it and it goes to the hearer. His thesis was that that is not altogether so. What in fact happens is that somebody speaks, and then he hears himself and what he has heard affects what he is going to say next and his machine, he claims, comes in there. Now what does his machine do? Metais claims that the imposition of a new mode of speech is made by the imposition of a new mode of hearing and therefore if he wants to get, shall we say, an Englishman speaking French, fluently like a Frenchman, he has to make that Englishman hear himself speaking French as if he were like a Frenchman and this is what he claims that his machine can do. He said that they made a Scotsman speak into this microphone in English and he heard himself as if he were an Englishman. I should think that was a great shock to him. One of the members in the audience said: "Can you make me speak like an American, with an American accent?" and so Metais said: "All right. I don't like demonstrating it here, because the acoustics are not right, the lighting is not right, there are many things that are not right." It was just an ordinary lecture room in our training centre, but he said he would try and he did. This man sat and read a book at this machine with the microphone in front of him

and his earphones on. The book was all about the sun and the stars and the moon and so on. The interesting thing was that the word "sun" kept cropping up and after about five minutes this man's voice became positively nasal. It sounded very much as if the frequency and the tone of his voice as far as "sun" was concerned was changing. This was quite evident to all of us there. And at this point the experiment stopped.

The interesting thing is that the person involved in the experiment didn't notice any change. He still heard himself or thought he heard himself as in fact he was speaking. There would be no question of hearing his own voice. All this is based on frequency—different frequencies in different languages, the level of the frequencies and what Metais claims is that this machine adjusts these frequencies and can in fact adjust the imbalance between the two ears. I understand that stammering, for instance, is caused, or can be caused, by an imbalance between the two ears. I believe that Tomatis is using this machine for that purpose. It is still in its experimental stage, the name of the machine is Aurel. At the present moment a language centre is being established in Paris and 200 of these machines are being installed and they are thinking of installing a computer in the basement of the building with a view to analysing the results over the next year or so—an applied mathematical analysis to linguistics. If anybody is interested in writing to this company to know more about this, I have their address. Dr. Tomatis has just written a book which has just been published in France in French and it's called *The Ear and Speech.* If anybody is interested, this may give you a few details. Well, that briefly is the electronic ear.

I would now like to go on to my third item, which is the adaptive teaching machine or SAKI, as we know it. We have heard quite a bit about teaching machines in the last few days. The adaptive type of teaching machine, to a large extent, was and is being developed in the U.K. by a man called Gordon Pask of Cybernetic Developments Ltd. and he claims that they can build an adaptive machine to teach a wide variety of skills. The idea behind this machine is that it counts the student's successes and failures, recording the numbers according to the type of error and then selects additional material for the student to work on in the areas in which he is weak and at the same time reduces the amount of work to be done in areas where he is strongest. They claim it is even possible for the machine to vary its speed of presentation according to the student's ability, thereby encouraging him to speed and success. Now SAKI itself originally stood for Solartron Automatic Keyboard Instructor, Solartron being the name of the company that made it. It is now called Self-Organising Automatic Keyboard Instructor. We bought this machine at a cost of £1,100 and I would like to tell you the reason we bought it and what we consider we have got out of it financially since we bought it. The reason we purchased it was that we were moving from a number of offices to a central office in London or one centre. This involved the purchase of a considerable amount of new computer equipment. We then were faced with the problem of training the punch-card operators to punch the cards for this new equipment. Up to this time, we have had to train punch-card operators in batches of six and keep one person full-time on training. We found it was taking six months to train these girls and only after three months could we put them on any particular job—and then their margin of error was as high as 20 per cent whereas we like to get the acceptable margin down to $2\frac{1}{2}$ per cent and for efficient operators $1\frac{1}{2}$ per cent or lower. So these were some of the reasons why we decided to buy this machine.

The machine itself stands so high and it is fitted with the normal type of keyboard that that operator is using at that particular time. The keyboard fits in a ledge in front of her rather like this except in the sitting position. In front is a display unit; on one side you load in the programme and on the top is a card which illustrates the programme and underneath those, underneath the card is a number of lights. These are called cue lights and the programmes you can put in this machine are basically alphabetic, numeric or a combination of alphabetic and numeric. You can adjust the speed of this machine; the errors that the girls make on it are recorded. What happens is this, supposing you have loaded it with, shall we say, an alphabetic programme; on your card on the top will appear a light and then shortly afterwards underneath will appear a cue light which corresponds to the place on the keyboard that the girl should punch to punch the correct hole. This process can be speeded up or slowed down; in fact the girl is looking at the white card and the light that comes on helps her in the first place to punch the right punch, but later on there is a delay between the white card light coming up and the cue light, and this delay becomes longer.

We have found that these girls take this machine as a challenge and try to beat it. Even our experienced operators want to get on the machine periodically and see if they can beat it. Another interesting thing about this is that when the operator punches a wrong key, an error is recorded. If she punches too hard an error is also recorded,

so it also teaches her to touch type. As she keeps punching the right keys, so the lights begin to diminish except for those where she keeps making errors, and those lights stay bright. In this way the machine makes her concentrate on the areas in which she is making the most errors.

Our achievements and findings on these machines are: in the first place the girls find the machine quite a challenge and try to beat it; of course, we can adjust the speed at which it goes, so we can always make sure that they just don't quite beat it. We never want them to get to that stage. The girls are not frightened of making mistakes—the machine is in a corner. They go there when they have a spare moment and practise on it. They now produce productive work within two or three weeks, as opposed to six months before. After three months they have a reasonable through-put and their error percentage is quite reasonable, whereas before it was about 20 per cent. We find that the rate of wastage of employees is lower than before. We don't somehow seem to get such a big turnover. We don't have to employ anybody especially on training. We can train them one at a time. When we started, we had a punch card unit section of 31 people. We now have a unit of 22 girls and a bigger through-put. The reason for this is that they have increased the through-put from say $2\frac{1}{4}$ to $2\frac{3}{4}$ million cards per year. An efficient operator can produce anything up to about 1,000 cards per day.

This is how we have been using an adaptive type teaching machine successfully and economically. Incidentally, you may hear that sometimes these machines are called Sids, which merely stands for self-instruction device.

I'd like to go on to a programmed text-book which is used by our associate company in America. It's a very interesting programmed course on automotive fundamentals and is designed for new sales trainees to familiarise them with the fundamentals of automobile operation. This programmed course is part of a larger course for prospective salesmen. It's a very simple booklet as I'll show you—Skinnerian in design and it's in a number of parts which I have tagged here. The second part says: "Basic engine parts and their function contd." So, we turn over the first page; you will see that it is in distinct paragraphs down the page with an S on the white parts, the number, and an R for response on the green parts of the number. This is called Sl and it says: "Continuing with diagram 2 AF 1, the strong foundation of the engine, the component in which all the parts are contained is called the block, see Fig. 9. The . . . which distributes the air fuel mixture to all cylinders is attached to the side of the block." The answer required there is "intake manifold" and if you turn the page you come to R1 with the answer; then you go on to S2, the next question and so on. The answer R2 is there and when you get to the end of the section you come back this way through the book. This is something which the salesmen do whilst they are on the job. In the book there are several pictures and diagrams which can be taken out. The student is asked various questions about them in the book and is given information about this. This is a programmed text-book for salesmen in order to teach them something fundamental about automotion used by our associates in America.

Coming on to a general topic, we play a number of business games in our organisations, although we don't like calling them business games. When we first went in for business games, we in Training Division closeted ourselves in one or two rooms in the training centre to work these things out. People began asking: "What are they doing in there?" And when they heard we were playing games, they said: "Aha, they are playing games while we're working." So we decided that we would henceforth use the term business project or exercise, as we found that this was more acceptable to the other members of our organisation. So I will now turn to business exercises rather than games.

Some of you may have had considerable experience with business games. As you know, they can be of two types—a computer type and a manual type. Some of these games can be very complicated and require a considerable amount of briefing which may take up to half a day or even more. We are considering, and I think we shall get down to it before the end of this year and I hope complete, a programmed instruction course for the introduction of a business game in order to try and cut out the extensive briefing that goes on before we can ever put on a business project.

The other thing we are interested in is refinery trainers or simulators. You can buy machines, for instance, which simulate the operations within a refinery and you can train your operators on these machines. Many of our associates have used these machines with considerable success, cutting down the amount of training time involved and also, more important, if a man is going to make an error, he makes it on a machine. If he makes it in the refinery, then instead of gasolene coming out, you get kerosene and that can be very awkward.

If we can be of any more help to you, please contact Shell South Africa. I am sure they will be only too willing to assist you in any way possible in this connection.