"Teaching Methods, the Brain, and Other Simple Matters" or "Are We Ready for Applied Neurolinguistics?"*

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In their constant search for the "best method", language teachers have sought insights from many disciplines: linguistics, psychology, sociology, education, etc. In the recent past, a new area of research has been called upon to make its contribution - the study of the human brain and its mechanisms. Even the media have already heralded the advent of a new era in education, an era in which both the left and the right cerebral hemispheres will be used to the fullest. The purpose of this paper is to examine the acceptability of these claims, and the potentiality of this contribution, with specific reference to second language teaching.

The question of which teaching method is "best" is a valid one. If our task is to teach learners a second (or foreign) language, it is only natural that we should want to know how best to do it; it is, in fact, a responsibility. An open-minded attitude and the desire to be adventuresome in the classroom, however, must be tempered by caution. We have to be respectful of our students and their attitudes, their likes and dislikes, their needs and objectives.

The question of which teaching method is best must be seen in relation to how students learn, and what they want or need to learn. Teaching has to be seen in relation to learning; there has to be a match. The issue is in reality reversed: only when we know how second/foreign languages are learned will we be able to find the best teaching method.

Research on second language learning has yielded some results in the last ten years, but we still have a long way.

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to go. We have not yet found the "universals" of second language acquisition. What researchers have found is "tendencies" and also, a considerable amount of "variability". What these findings seem to be saying is that not all learners learn in exactly the same way; that although there appear to be "tendencies" there is also "variability", and that this variability may be caused by a number of factors: social, cognitive, linguistic, and so on.

How can language teachers deal with this variability margin? If students do not all learn in the same way, how can they all be taught in the same way? Can there be a method that can accommodate all learning styles and strategies? And also, of course, is there a method that will please all teachers? Is there, in fact, a method that will be "best" for everybody?

There are people who believe that they have, in fact, found the best method. But proponents and supporters of specific methods have only convinced some people, some of the time. Could it be that despite the soundness, appropriateness, and validity claimed for these methods, they fail to account for the "variability" factor in both learners and teachers? If this is true, the only method that will ever be acceptable and effective with everybody is one based on an eclectic approach, a method that is flexible enough to deal with both individual student differences, and with teacher strategies and preferences. Until we find the elusive final answer in second language learning, a sensible and sensitive eclecticism appears to be the only alternative.

In the meantime, second language acquisition researchers must continue to research, and second language teachers must continue to teach, always on the lookout for new insights or new answers in the research which is being carried out.
In the fairly recent past, another area of research has entered the arena, and has attracted the attention of educators and methodologists — that of the study of the brain, and more specifically in our case, the discipline of neuro-linguistics. The impact of this discipline has been so strong that it has found its way into the media, and talks about male-female brain differences, and right/left hemisphere functions are not uncommon at civilized cocktail parties.

In the September 1980 issue of Saturday Night Magazine, in an article entitled "Of Two Brains" we learn that "these days field workers in anthropology sometimes report on whether the bias of a given culture is right- or left-hemisphere dominant. An English professor at Simon Fraser University is writing a paper that deals with right-brain responses to the tragedy of KING LEAR. Educators have begun calling for curricula that will engage both sides of the brain instead of only the left hemisphere. Even business finds interest in the brain's hemispheres. 'The right hemisphere of the truly creative manager,' suggests one American marketing professor,' is continually scanning the environment, perceiving, brainstorming, intuiting, day-dreaming,' " And, they conclude: "Right/left-brain theory, once confined to laboratories and journals of neuropsychology, is moving into the world." So, naturally, we ask ourselves, what is this all about? What is in it for us, language teachers, or language methodologists? This is the question that I will try to answer in this paper.

The field of neurolinguistics is not necessarily new. Questions about the relationship between language and the brain are questions of long standing, at least in neurology. It is only recently, however, that linguists have taken a
keen and focused interest in the brain, and although the field is still fairly uncrowded, its issues, questions, and answers, are beginning to filter into the applied areas. What is interesting and important to note, however, is that neurologists and theoretical neurolinguists are not overly enthusiastic about the interest that we have taken in their work, and are extremely hesitant to approve of our applications of their findings.

The reasons for their reticence are easy to understand. Although students of the brain have made tremendous strides in the last decade, the very nature of the object of their study makes research in humans difficult and speculative. Since experimentation with healthy human brains is relatively limited, they have to use animals or observe pathological cases. Much, but not all, that is known about the human brain is, in fact, inferred from animal studies or pathological cases. The inferences may be valid, but they are still inferences.

In my search for answers to questions in second language learning and second language teaching, I have identified the following three areas in which the study of the brain may provide us with valuable insights, however tentative they might be. The first two have to do with learning, and the third, with teaching.

1. The organization of languages in the brain of bilinguals.
2. The existence of a neurological critical period for second language learning.
3. The localization of specific functions in the brain and teaching methods.

Let me start by giving you a very simplistic picture of the brain and its relationship to language. An examination of the surface of the human brain will show it to
be a large, bilaterally symmetrical organ; it is possible to distinguish, then, a right "half" and a left "half" or a right and a left hemisphere. The outer surfaces of the brain or cerebral cortex contains subdivisions which have highly specialized functions. I cannot begin to tell you how crude and incomplete this picture is. My only purpose right now is to locate some of the areas that I am going to talk about and to mention some of the terms that I will need to use.

For most people, the left hemisphere (or the left side of the brain) is known to be dominant for language. This means that language is processed primarily by the left side of the brain. Notice, however, the following qualifications: 1. For some people, it is the right hemisphere that has been shown to be dominant for language, and 2. In some individuals, language appears to be more diffusely represented in both hemispheres (not just one).

But differences among individual brains do not end there: brains may differ in size and weight, and specific areas may also differ, in some cases considerably, in size and structure. It has also been found that some people are missing certain parts of their brain, particularly connectors, like the corpus callosum, which is the connector between the left and the right hemispheres. These are genetically determined differences; but external factors, such as nutrition, and environment, can also affect brain development and function. What kinds of effects these individual differences have on brain function is not well known, and some may not be significant at all, but it is clear that although a brain is a brain is a brain, we can also say that a brain is not a brain is not a brain!

The picture of localization of language in the brain is further complicated by the fact that in actual language
use we utilize many other areas of the brain: the motor cortex (to speak, gesticulate and write), the visual cortex (to read) and the auditory cortex (to hear). Also, each one of those general areas contains sub-areas, specialized in and controlling smaller and more specialized behaviors. Only in a general and theoretical sense, can we say that "language is located in the left hemisphere".

Let us, for a moment, put aside the issue of individual brain differences in general, and language processing in particular, and let us assume that in all monolinguals the left hemisphere is dominant for language. What happens when we learn a second language? Are bilingual brains different from monolingual brains? (The term "bilingual" is used here in a very general sense, meaning an individual who, to some extent, knows and uses two languages). Theoretically, there is no a priori reason to assume that in bilinguals, both $L_1$ and $L_2$ have to be localized in the left hemisphere, or in the same way.

The possible alternatives are: 1) That both languages ($L_1$ and $L_2$) are localized in the same hemisphere (the left for most individuals); 2) That both languages are localized in different hemispheres (the native language in the L.H., the second language in the R.H.) because of the neurolinguistic nature of bilingualism or because specific languages "prefer" one hemisphere or the other); and 3) (an intermediary position) that the degree of hemispheric involvement in bilinguals may be different, that is, that second languages are less localized.

The answer to this question is of crucial interest to us because if the brain processes second languages differently from the first language, all the generalizations that have been made about language and the brain are
invalid for second languages, and learning second languages will have to be considered essentially different from learning a first.

Let me start by discussing the last position I mentioned, namely, that in bilinguals the second language is localized in both hemispheres, not just the left. In a book published in 1978, The Bilingual Brain, Martin Albert and Loraine Obler present arguments in support of this alternative. Their conclusions are as follows (Please notice the hedges, or qualifications):

"1. Language organization in the brain of the average bilingual may be more bilateral than in that of a monolingual.
2. Patterns of cerebral dominance may be different for each language in the brain of a bilingual.
3. Differential cerebral lateralization for each language is not random but is influenced by many different factors, including age, manner, and modality of second language acquisition.
4. Cerebral dominance for language in the bilingual is not a rigid, predetermined, easily predicted phenomenon; it is, rather, a dynamic process, subject to variation throughout life and sensitive to environmental, especially educational, influences."


If Albert and Obler are correct, their findings would have profound significance for second language teaching. As they themselves put it at the very end of their book, in a section called "speculative suggestions": "If it is true that the right hemisphere plays a major role in the acquisition of a second language, at any age, then it might be useful to develop a program that emphasizes so-called 'right hemisphere strategies'. For example, a second
language might be more easily learned if it were taught through nursery rhymes, music, dance, or techniques emphasizing visuospatial skills" (Albert and Obler, 1978, p.254).

In addition, some of the evidence they cite is also of interest to us. They claim that asymmetrical hemispheric dominance may be brought about by language specific factors. They cite the case of Hebrew (which is read from R to L) and English (which is read from L to R), a fact that may encourage different cerebral organizations in the learner. Is this the neurological angle of the contrastive analysis hypothesis? Does this mean that it would be easier for a literate speaker of Hebrew to learn Urdu than to learn English? Or that literate speakers of languages like Chinese would have a hard time because written Chinese is organized linearly in a direction different from English, and unlike English, is ideographic rather than phonetic in nature?

In the December 1980 issue of Science, a magazine published by the American Association for the Advancement of Science in order to "bridge the distance between science and citizen", there is an article called "The Japanese Brain". This article reports on the findings of a Japanese scientist, Tadanobu Tsunoda, who claims that because of the peculiar nature of the Japanese language, Japanese brains function differently from other people's. Tsunoda's position appears to support the claim that language localization in the brain is a function of the specific language, rather than biologically or genetically determined. Tsunoda's results are intriguing, but none of his experiments has been duplicated and most scientists have adopted a "wait-and-see" attitude.
Albert and Obler's position (that second languages are processed differently from the first language), is not widely accepted either. At a recent symposium on "Neurolinguistics and Second Language Acquisition" held in Rio de Janeiro in April, 1980, Harold Goodglass, a Professor of Neuropsychology at Boston University said: "I can't even imagine why anyone would even suppose that bilinguals process their L2 differently from the way in which monolinguals process L1. Monolinguals play all kinds of language 'games' with one hemisphere. Why should bilinguals be any different?"

Both H. Goodglass and Jean Berko Gleason, a Professor of Psychology at Boston University, found Albert and Obler's evidence not conclusive for several reasons: First, the results of the experimental studies constitute weak evidence because there is a lot of individual variation, and because most of the differences found are minimal, particularly when compared to evidence for cerebral localization of other phenomena (music, noise, etc.). They also felt there was too much variation in retests. They felt that both the differences and the variation in the retests could have been an artifact of the tests used.

Also, they feel that evidence from pathological cases to explain non-pathological phenomena cannot be considered conclusive, particularly when there appears to be some counterevidence in the literature on poliglot aphasia. Harry Whitaker, Professor of Psychology and Neurology at the University of Rochester, at the same symposium, cited some of this counterevidence to Albert and Obler's position. In experiments done with bilingual epileptic patients during surgery, it was found that electrical stimulation of certain areas affected both languages equally, or one language more than the other,
or one language or the other. This seems to indicate that in some cases, contrary to what Albert and Obler claim, two languages can, in fact, be localized in the same hemisphere, and that there is partial (or total) overlapping of certain functions in two different languages in the same area of the brain.

M. Paradis, a Professor of Linguistics at McGill University, studied the patterns of recovery from aphasia in bilinguals (Paradis, 1977) and discovered seven different patterns: 1. **Parallel** (90%) both languages recovered at the same rate, to the same degree. 2. **Differential**: both languages recovered together but not at the same speed or to the same degree. 3. **Successive**: one language is recovered, and then the other begins to appear, and eventually catches up. 4. **Selective**: one of the two languages is not recovered at all – or comprehension in both is recovered, but speech in only one. 5. **Mixed**: while recovering, the two languages are mixed, at all levels. 6. **Antagonistic**: one language appears and then, when the second language appears, the first regresses and disappears; and 7. **Seesaw**: when recovery in one or the other language varies on a day to day basis for sometime.

From this kind of evidence we can infer that in most bilinguals (90%) both languages are affected similarly and recover similarly from aphasia, and that, and this is a bigger jump, before the lesion occurred, both languages must have been localized in the same area of the brain – which would be counterevidence to Albert and Obler's position.

So it would appear that, for the most part, the brain deals with second languages in very much the same way as it deals with the first and that evidence to the contrary is, at present, either inconclusive or unreliable. The fact that so much individual variation has been noticed,
however, suggests that any wholesale application of these findings to language pedagogy would be premature and unwise.

The Critical Period

It has traditionally been assumed that children learn second languages more easily than adults do, and that the onset of puberty marks the end of this period of language acquisition facility, also known as the critical period.

E. Lenneberg was one of the first neurolinguists to relate the notion of a biological critical period for language acquisition to second language learning. He also related the end of the critical period to the appearance of foreign accents in adults (Lenneberg, 1967).

Although the notion of a critical period is widely accepted, not everyone believes that the causes are biological. E. Rosansky (1975) argues for a cognitive critical period which ends with the onset of Piaget's stage of formal operations; whereas H.D. Brown (1980) suggests that the causes are sociocultural. H. Seliger (1978) believes that the critical period is of a biological nature, or more specifically that it is related to cerebral maturation but he argues, quite convincingly, that because different parts of the brain mature at different rates, there are, in fact, multiple critical periods for different functions.

Regardless of whether or not there is a critical period for second language learning, or whether its causes are biological, psychological, or sociocultural, the fact remains that both children and adults are capable of learning second languages. B. Taylor (1974) argues, in fact, that because of their superior cognitive maturity, adults are, in some sense, "better" language learners than children.
The whole issue of the nature of foreign accents is a very interesting one, both theoretically and practically. Should we bother teaching adults pronunciation? Is it hopeless? Is it necessary?

Like everything else in this paper, the answers are complex and unsatisfactory. First of all, it is not true that children always learn second languages without a foreign accent. The questions that we posited for adults should then be extended to at least some children. There is evidence, for example, that some children who are bilingual from birth speak one of their two languages with an accent (Yorio, in preparation). There is also evidence that children in bilingual immersion programs speak the second language with traces of native language interference (Selinker, et al 1975). Biological or neurological arguments fail to account for these two cases. The explanation appears to be of a sociocultural nature—the absence of native peers, or of a natural native environment are the probable causes for the presence of the foreign accent in these two cases.

With adults, the situation is different and much less clear. Whether or not teachers of adult learners should teach, or attempt to teach pronunciation depends very much on what the learner wants. Societal pressure, and the desire to identify with, integrate with or even assimilate into the host community can make some second language learners want to "lose their accent". Other learners, with a more pragmatic motivation, couldn't care less; their foreign accent is not an issue, all they want is to function effectively in the second language. Another group of learners may not want to lose their accent; they may feel that, being part of their native cultural identity, a foreign accent is something that should be preserved rather than erradicated.
Since all these positions are valid and reasonable, we, as teachers and curriculum planners, must be respectful of our students' wishes.

The question that remains to be answered is whether we can help those adult students who want to acquire a native-like pronunciation in their second language. How much can we do? How much can they accomplish? Can neuro-linguistics give us an answer?

First of all, the strong version of the critical period for accent theory, and certainly classroom experience, tell us that adults are capable of improving their pronunciation (with varying degrees of success) but that the total loss of their "foreign" accent is not possible. Selinker (1972) has suggested that five percent of all adult second language learners acquire a native-like accent. Scovel (In press) does not discount the possibility that "there might exist those rare individuals who can acquire accentless pronunciation even in adulthood". G. Neufeld (1978, 1979, 1980) has claimed that all adults are capable of acquiring native pronunciation in a second language. Selinker's and Scovel's position is, so far as I can determine, anecdotal and unsubstantiated. Neufeld's claim, based on experimental data, is not conclusive because the nature and results of Neufeld's work do not warrant such sweeping generalization.

H. Whitaker's theory of automatization provides us with an interesting neurological explanation for both the presence of a foreign accent, and for the individual variation evident in the success of L2 learners to acquire a native-like pronunciation.

Whitaker (1971, 1979) claims that certain bundles of muscles learn to act together in neurological/neurolinguistic routines which become programmed in the brain. These
routines are extremely complex and cannot be controlled consciously. This means that certain behaviors, action sequences, or skills are performed automatically, very efficiently, and very fast.

Whitaker further claims that automatization is known to be related to age, and that it may be completed by the end of the critical period. He also notes that there may be individual variation in automatization.

This theory of automatization explains why certain very refined behaviours like those necessary for certain musical instruments or ballet, and certain sports (like gymnastics and swimming) are most easily acquired before puberty, and why they are almost impossible to acquire to the same degree at a later age. The same might be true of the acquisition of phonology both in first and second language acquisition. This hypothesis is interesting because it accounts for the apparent incongruity found in L2 speakers who are capable of distinguishing and producing individual sounds (which are not automatized), and yet fail to use the same sounds correctly or consistently when they appear in more complex phonological sequences. These complex sequences may, in fact, need to be automatized for complete mastery and control – a neurological feat which adult L2 learners may not be able to accomplish totally.

From a neurological point of view, the teaching of pronunciation has to be seen as a case in which practice can make better, but seldom if ever, perfect.

In addition, the student's motivation and a supportive language environment will certainly contribute to success.

Having dealt with the simple matters, we finally come to the central question of the paper: the relationship between teaching methods and the brain. I thought it necessary to leave this issue until the end, because I wanted to give you an idea of where we stand in relation to those questions that must be answered first, namely,
language and the brain, and bilingualism and the brain. As I said at the beginning of this paper, teaching must be understood as dependent on learning.

And where do we stand? What can neurolinguistics tell us,...for sure? Are we ready for "applied neurolinguistics"? Is neurolinguistics ready for us? The answer, I believe, is not totally positive or enthusiastic, regardless of what the media may tell us.

T. Walsh and K. Diller have dealt with the neurolinguistic foundations of language teaching methods (Walsh and Diller, 1978; and Diller and Walsh, 1978). They describe how different methods utilize different areas of the brain to varying degrees, and how in some cases, certain specific language areas are not tapped at all. Diller (In press) claims that neurologically speaking, a good language teaching method must contain three essential characteristics: comprehension, problem solving, and meaningful practice.

Although Walsh and Diller's arguments make sense, they are largely based on pathological evidence which we must accept with caution. When they say: "different strategies for teaching foreign languages can exercise widely differing neurolinguistic pathways according to the structure of the method," (Walsh and Diller, 1978, p.10) we must remember that, however sensible, that statement is an inference based on knowledge of the workings of the brain mostly derived from studies done on aphasia patients. These patients may not only have been afflicted differently, but their brains cannot even by assumed to have been identical before the lesions occurred.

It is clear that different methods emphasize different tasks or skills. It is also clear that some are more rigid than others. A method that somehow incorporates meaningful
listening and speaking practice, reading and writing skills, language and communicative games, plus cultural orientation is richer than, say, a method that requires that students translate from the target language into the native language with the aid of a dictionary, and no more! I know people, however, who would be much happier doing the latter, and might have a very rough time trying to learn a second language using the richer, more encompassing method.

A banana-split is a wonderful treat for some people but way too rich for others. In this respect, the message that we get from neurolinguistics, apart from the fact that any generalization might be hasty and dangerous, is no different from the message that we get from research in psycho and sociolinguistics: we do not all deal with language and language learning in exactly the same way. Because the brain has many pathways and because we may not all use those pathways in the same way or to the same degree, language teaching methods should be rich rather than limited, flexible rather than rigid. The best teaching method is the one that allows individualization and choice. Richness of method, without provision for choice, is not adequate; it is like forcing everybody to eat the banana split.

My reasons for advocating a rich, flexible, eclectic approach to language teaching are, in some sense, based on what we don't know, rather than on what we do know. It seems to me that until we know, for sure, how the brain works and how the mind operates, we must be very careful: we must try to make the learning task as pleasant, harmless and meaningful as possible and to offer everyone a chance to do "his or her thing".

But, you may ask, what if we offer a large variety of choices and all kinds of opportunities for individualization, and we find that certain students are content with what we consider very limited pickings. What if we have a student who firmly believes that the only way to learn
a second language is to memorize dictionary definitions? Shouldn't we make him or her more flexible? Shouldn't we try to develop new learning strategies in our students?

The answer is: definitely yes. Our task, as educators, most certainly includes the broadening of our students' horizons in every respect. We must both accept their ways, and show them new ones. We must try to be resourceful, patient, imaginative, persuasive, eclectic, and, above all, flexible. We must not, however, force any part of the banana split down anybody's throat.

If we believed, like the media, that the study of the brain would give us the final answer so that we could apply it in next year's program, we were too hopeful. As Harold Goodglass said: "We are thousands of years away from understanding the brain with any accuracy". It seems then, that we are going to have to wait, and, who knows? we may eventually find that banana-splits are really lethal, and then how would we feel?
REFERENCES


