Bilinguism

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The neuropsychology of bilinguism

Modern world is not a world of a single language. Human society is transforming itself into a big moving body, its individuals are changing their position incredibly fast, and I am not talking only about their physical selves, their mind is traveling too. What I mean by traveling mind, is their capacity of acquiring ideas of others, and spreading their own ideas through speaking, reading and writing, skills whose powers were increased by the that that we call telecommunication, phones, TV, radio, and of course the last incredible invention ? internet. All these devises permit to all existing languages to extend. In the beginning it was only English, but then quite fast, one after another human languages are entering the virtual scene. Small communities are formed. And even now to understand them, theirs creators have to learn them. Instead of a standard communicational devise users have to adopt themselves more and more to different linguistic environments, sometimes only to the written ones, their brain has to create an image, or a model of that world, in order to survive, in other words to try to learn other languages, that are different then their mother tongue. In this essay I will try to present the evidence about what is happening on the neurological level while learning a second language. I mean by a second language, those languages that are considered by linguistic experts as different, excluding dialects, scientific jargons, and also there is no data about Pigeons or Creoles (new created languages).

More and more neuropsychological research is made in order to understand the complex phenomena of bilingualism. At first blush, the bilingual would seem to be the ideal experimental subject for the modern neuropsychologist. In the bilingual we have personified the essence of the experiment with two competing channels: one brain, two simultaneous systems, no fancy experimental technology necessary, no problems with finding controls matched for age, gender, education, or handedness. But as soon as you start to make first tests, it turns that no two bilinguals looks to be the same on any scale, of course there are similarities in language and neurolinguistic behaviors.
Little history
One hundred years ago, the main topic of neurological research concerning bilingualism was around one single topic. In the aphasic polyglot, which language returns first, and why? A lot of data come from the monolingual aphasics, and of curse from the bilinguals aphasics that were tested only in one language. In case of bilinguals, the most interesting cases were those when in which at least one language was entirely inaccessible, while in the other language, or languages the patient displayed aphasic symptoms ? a pattern termed differential recovery (L.Obler,1984). More recently (idem) it has been observed that those more then 200 cases of bilingual aphasics described in the literature were not at all the standardized clinical norm; it seems that both or all languages are impaired and recover in like manner, in proportion in how well they were known at the moment of the aphasia-producing event. And here a lot of differences appear. Which of the polyglots will recover in differential way, and which in a parallel way? Only in 1977, Paradis articulated the numerous possibilities for order and type of selective impairment in the polyglot aphasic, giving us further evidence of individual differences.
One hundred years ago, however, authors focused on those patients they saw with differential discovery, which served to encourage investigatorâ€™s speculations on the reasons why one language or another recovered first. The notions the were agreed on were dealing mostly with potency; the language learned first, returned first(Ribot, 1882), the language most familiar to the aphasic returned first(Pitres, 1895), or the language bearing most emotional weight returned first(Minkowski, 1963). More recently, the discussion has centered towards the notion of inhibition (specifically, selective inhibition of the more inaccessible language).
It is interesting that other two topics were much more less discussed: first, whether there were any differences in the organization of the two languages of the bilingual, a question that remained to be rephrased in terms of the notion of cerebral liberalization in further research; second ? where is the mechanism that permits healthy bilinguals to switch between their two languages? Lesions both right and left and both posterior and anterior had been postulated in a literature produced since 1920.
The period of 1960 until the end of 70â€™s neurophisiologists drop this topic leaving it for linguists and psychologists.

â€˜80s
The questions in discussion were much more correlated to neurophisiological research. Albert and Obler (1978) in The Bilingual Brain are trying to answer if to some extent, certain elements of the two languages are organized more in compound fashion while other elements are organized more in independent fashion in the same individual. They used experimental methods such free associations to single word stimuli, which were likely to provide data for coordinateness and list-recall paradigms offering data for compoundness. Thus compound is not a label for an individual, but the psycholinguistic approach for specific language tasks. Furthermore compound and coordinate organizational structures coexist within the same individual.
Another interesting topic treated in the bilingual Brain was age of second language acquisition. In particular famous

Lennebergâ€™s (1067) notion of the critical period in a second language learning; and of course proficiency. It looks like, from empirical observations, that what is learned could conceivably influence how ones brain was organized for it.
Also authors propose that Translation should be viewed as a special skill, independent of other language skills; the bilingual, like the monolingual, can live in a perfectly healthy life without the least need or desire to translate. Abidi(1982) discovered two cases of aphasia who had some premorbid experience in conversational translation from each of their languages to another. With aphasia, each could translate only from the better spoken language to the one that was otherwise inaccessible. That is to say, the translation task facilitated production of the language normally inaccessible because of the accident.
Recent data on cerebral lateralizations shows that bilinguals may well have greater right-hemisphere participation in language processing than monolinguals. Dichotic and tachitoscopic data, as right hemisphere brain injuries seems to show that; hence there are a number of contradictions, some maintaining that bilinguals showed a greater degrees of left ?hemisphere dominance in one language than the other and other supporting the orthogonal notion that bilinguals showed greater right hemisphere participation for both their languages then did monolinguals for their single language. (Obler at all, 1990) The difficulties range from the specifics of subject-selections criteria among bilinguals(who learned what, who and how, and how have they use it?), to problems of creating equivalent stimulus sets for two languages, to problems of statistical manipulation of data, interpretations, number of subjects. And when the case is becoming even more complex, ex: trilinguals, (ex:Paradis, 1981 reports a case of â€œselective cross aphasiaâ€• in a trilingual patient, after removal of a parasitic cyst from the right prerolandic area, the right handed patient presented aphasic behavior in one of his two early-learned tongues (Gujarati) and no aphasic disorder in his two other languages(French and Malagasy).
Then, in 1992, a group of American researchers Sussman & co, measure the hemisphere predominance, using tachitoscopic and dichotomic testing, they seemed to reach the conclusion that if a second language is learned until the age of 6, then the localization is more probably in the left hemisphere, if it is after that age then it is becoming more under the right dominance. Means that if the second language is learned before the age of 6, the neurological structure is very similar to those of monolinguals, and if not then the picture is considerably different. Also it seems that there is some differences between how the later learners learned the language, and it is not about learning the language using or not printed materials, and also it has nothing to do with translation method, but with the fact if the language was learned via a formal or informal method of teaching. It seems that those who learned a second language after 6 years, in an informal way and are proficient in it at different tests, shows a greater activation in the right hemisphere, and those who learned it in a formal way show left hemisphere dominance. So it is possible then that some processes involved in second language acquisition may call on right-hemisphere cognitive skills, while others will rely on left-hemisphere skills.
It is well known from the studies of Brokaâ€™s and Wernickeâ€™s aphasics, that language is definitely located in the left hemisphere, at least generally speaking. It seems that even sign languages that uses a different â€œphonological channelâ€• comparing to spoken languages, (signs instead of phonemes) in contradiction with some expectations(it is known that right hemisphere is responsible for spatial ability,) Ursula Belucci is showing that even in that cases(death people aphasia) the sign languages are showing same neurological features as spoken languages, meaning that they are located in the left hemisphere. But in case of language-related dichotomic tasks, (ex: taping and speaking in the same time) use much more right hemisphere then those who are monolinguals.

Future research
I think one very interesting point is: where from the language finds enough resources in order to come back to life, I mean after a stroke, how it is happened that language comes back again. I think here should be involved rules, that are dealing at almost cellular level, a) how neurons migrate ,b) how new nervous cells substitute dead cells, c)what is the role of glial cells in the macrotasks? The functions of axons and dendrites, and also the microorganites of the nervous cell are still not well understood.
Other interesting topic is: starting from neurological data, to predict how many languages an individual can possibly master? And then, the dialects, neurologically talking, are those phenomena considered to be separate languages? And then of course, writing and reading, unlike alphabet languages, written Chinese and Japanese uses characters as a basic unit, which map onto meaningful morphemes rather than phonemes in the spoken language. Thus, a Chinese character has a more direct connection with its meaning than a written word in English does. It can be predicted that the morphemic nature of the Chinese and Japanese languages would lead Chinese and Japanese people to organize semantic knowledge more flexible then do alphabet languages speakers, and it is interesting to figure out, what is happening on the neurological level, when a non character user is learning a character language(ex. An English speaker learns Chinese). A connected to this idea is the study of those who study sign languages, I can speculate, that in case of sign language late students, certain skills that are normally located in the right hemisphere, somehow migrate form the right hemisphere to the left one, in the same time with growing proficiency, hence it is only a speculation, MRI data will be very helpful, but unfortunately this technique is still expansive, and not easy accessible, hence there are some photos(that I found on internet, showing the areas responsible for speech in two different languages, Spanish and English, the file is attached.

As conclusion, at this point in the scientific literature there are two main theories that explain second language acquisition: Extended system hypothesis In this case they postulate a large language stock made up of elements from each language. When we learn a second language, the new sounds are treated as allophones (variants of existing phonemes) and are supported by the same neural mechanism that underlies all phonemes.

Evidence for this position is that for instance bilinguals can speak one language with the accent of the other language, and another supporting fact is that many bilingual aphasics are at first impaired in all their languages.
Dual system hypothesis Those who propose that within the same general language area, there are different networks of neural connections underlying each level of the language (sounds, grammar, words). But the two language systems are separately represented in the brain.
Paradis (1981) proposed a compromise solution to the two hypotheses. He agrees that both languages might be stored in identical ways in a single extended system, but he also thinks that the elements of each language probably form separate networks, subsystems within the larger system. He writes: "according to this hypothesis (the subset hypothesis) bilinguals have to subsets of neural connections, one for each language while at the same time they posses one larger set from which they are able to draw elements of either language at any time". In addition, bilinguals may stay within a subsystem when speaking or bring in elements from the other subsystem- code switching.
The bilingual brain is still very unknown. A lot of research is still to be done to clarify many questions around bilingualism.

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Source: http://www.matsuishi-lab.org/bilinguism.htm