

Neurolinguistic issues

The physiological aspect of language storage in the brain and whether or not two languages function *independently* or *interdependently* is an area of further research relating to hypotheses of

- separate storage and
- shared storage

This is further complicated by consideration of whether or not this differs between

- compound or early bilinguals and
- co-ordinate or late bilinguals

This seems to be an area of disagreement, although there is consensus that *both* languages are active even when only one is being used and that they function independently even if there is shared processing. As quoted in Baker (2011: 146), Bialystok (2001: 104) states: “Adults are not confused by the fact that two linguistic systems share processing space for knowledge and communication”.

Interest in the cognitive aspects and implications of being bilingual have led to research in areas such as *neurolinguistics* and attempts to answer questions related to any differences which may exist in the way a bilingual’s brain functions from that of a monolingual, particularly in terms of:

- language storage
- language processing

However, many of the questions related to this area have not yet been answered. Could this even vary according to the number of languages an individual can speak?

It is generally acknowledged that the left hemisphere of the brain is used for language processing in right-handed adults, what is referred to as *left lateralization* (see Figure 3), but are bilinguals different in this respect?

Research has recently discovered (Hull & Vaid, 2007) that bilinguals seem to be less left-lateralized than monolinguals i.e. more *bilateral*, with early fluent bilinguals being more so than late fluent bilinguals. Baker (2017: 148-49) refers to research by Bialystok et al. (2005) involving magnetoencephalography (MEG) for neural investigation of the brain of young bilingual and monolingual adults using the Simon Task. Compared with monolinguals, the bilinguals used more areas of the brain as well as the Broca’s area which is associated with language processing.

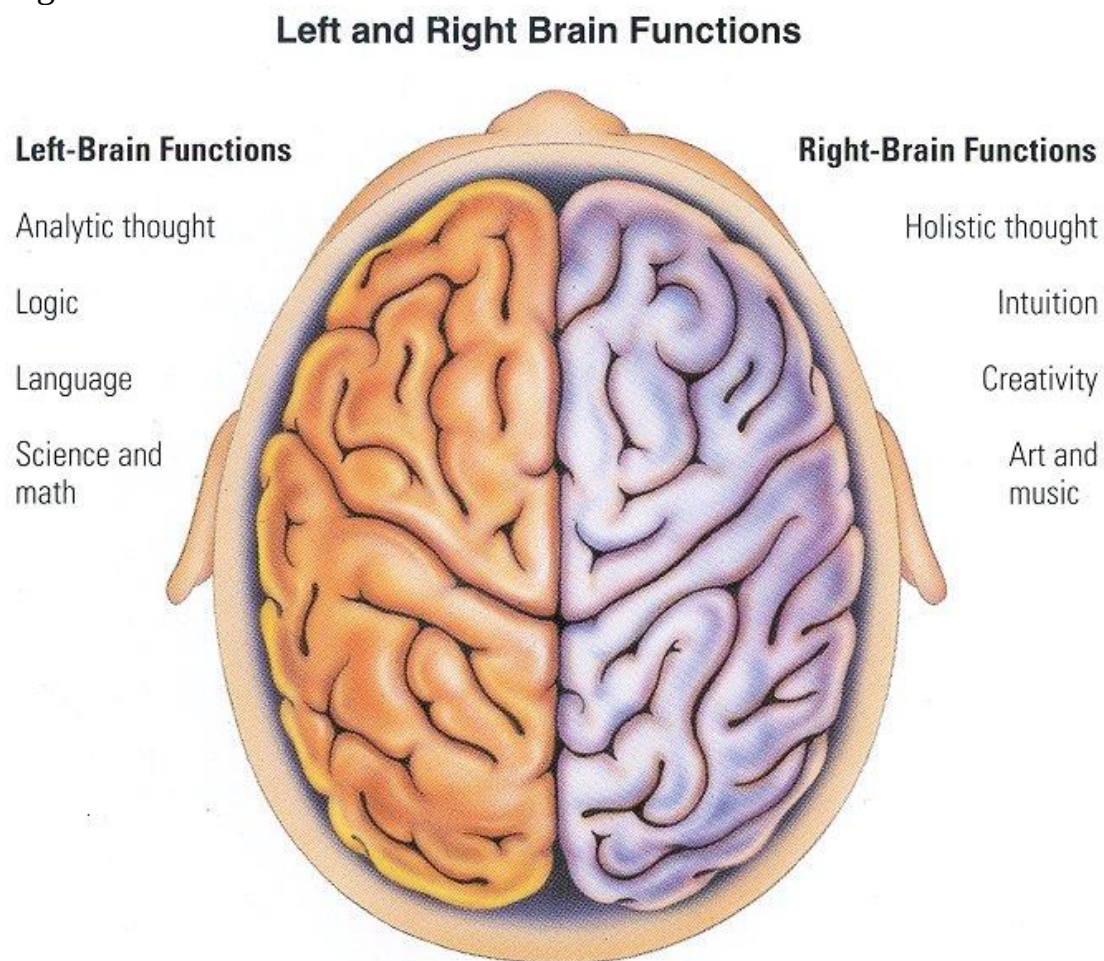
Such research has been dependent on scientific advancement and the ability to create images of the brain or *neuroimaging*. Neuroimaging enables one to understand:

- *where* things happen in the brain (by means of fMRI)
- *when* it happens (e.g. the use of event-related brain potentials or ERP) (see Baker, 2017:139-40).

Research using fMRI conducted by Kim et al. (1997) seemed to indicate that there is also a difference between late bilinguals and early bilinguals (those who learn both languages before the age of three years). The research showed that in the case of late bilinguals the two languages were stored more separately than in early bilinguals where both languages appeared in adjacent areas, thus making the regions encompassing the processing of *both* languages more identical. However, as Baker (2017:147-48) points out, such research needs further investigation and replication due to certain methodological issues:

- the size of the sample being restricted to only six bilinguals in each group despite the range of languages involved
- being based on *thinking* rather than on speech production
- most data not indicating any differences between the two groups (i.e. early and late bilinguals)
- other research using ERP and PET having produced contrary results e.g. Goral et al. (2002).
(See also Baker, 2017: 141).

Figure 3



Baker (2017) draws our attention to the *status quo* of research in this controversial area, pointing out that:

...we are only just beginning to understand the neural architecture underlying language and cognitive processing in individuals. There is a danger of believing that brain images represent thought. Such snapshot brain images are a visible consequence of thinking but do not reveal the complex operation of the mind. The correspondence between these images of the brain and thought processes is not yet known. (Baker, 2017:141)

De Bot (2008) offers the following reason for the lack of progress made by neuroimaging in understanding cognitive and language processing in bilinguals:

- the fact that the neuroscientists involved in studies are uninitiated in many significant aspects of bilingualism, thus ignoring variables

of which linguists have always been aware and which impact directly on linguistic processing e.g. levels of proficiency, age of second-language acquisition, levels of motivation, linguistic context and use, etc.

- the fact that neuroscientists tend to ignore the wide variations in brain activity amongst bilinguals which, possibly resulting from varying stages in bilingual development, could provide the key to linguistic and cognitive processing.

Research has also indicated that bilingualism or the acquisition of a second language increases the density of grey matter in the brain (Mechelli et al., 2004), early bilinguals again showing superiority over late bilinguals with both showing superiority over monolinguals. The research shows that grey matter:

- increases with second language proficiency but decreases with age of acquisition
- is activated by the acquisition of vocabulary in both bilinguals and monolinguals
- enlarges in different areas according to the languages used.