object?) determines the relative differential hemispheric activation[4].

Shaywitz and his colleagues[5] asked their subjects (19 males and 19 females) to map the given letter strings onto phonological representations. In other words, the subjects are to determine if two nonsenseword strings rhymed. The test involves phoneme coding. Neural activation during rhyming in males was lateralized predominantly to the left inferior frontal regions (mean number of pixels activated were 11.7 and 5.0 for the left hemisphere and the right hemisphere respectively). In contrast, activation during this same task in females engaged this region bilaterally (mean number of corresponding number of pixels activated for females were 9.4 and 12 in the left hemisphere and the right hemisphere respectively). Shaywitz and his associates thus demonstrated that in a site uniquely serving phonological processing, inferior frontal gyrus (IFG), females devote greater right hemispheric resources to the task. Also, cumulatively larger areas in IFG in both the hemispheres are seen activated in females when compared to males.

However, Fink and his associates in their experiments apparently used only male subjects. Will the results from the female subjects be different in any manner for global/local processing of letter-based and object-based stimuli? In other words, who among the males and females are more likely to 'miss the wood for the trees'? Does Shaywitz *et al.*'s work indicate a natural flair for lullaby among females? I am sure the evolutionists among the biologists are sure to hijack the answers to these and similar questions (as and when available) to see in the answers some biological advantage to the *Homo sapiens* as a species! In the meantime, can we not think of enlarging the scope of our endeavours in brain research so as to find applications in as broad a realm as education, besides the efforts directed towards the amelioration of disorders/diseases afflicting the brain[6]?

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Magnetic reconnection on the Sun: Ultraviolet observations of bi-directional plasma jets

B. N. Dwivedi and Anita Mohan

Magnetic field reconnection transcends the traditional disciplines of laboratory, space and cosmic plasma physics. The process is known to occur in fusion devices such as tokamaks where it causes major disruption of the plasma confinement. It is thought to occur in solar flares and in other energetic events on the Sun. It takes place at planetary magnetopauses, and in planetary, as well as cometary, magnetic tails. Reconnection also plays an important role in other cosmic objects such as accretion discs, and in a variety of current sheets occurring in interplanetary, interstellar, and intergalactic space. Detailed study of reconnection processes in the laboratory, in computer simulations, in the Earth's magnetosphere and in the solar plasma is, therefore, in the forefront of current researches.

In cosmic plasmas, large scale lengths L, large velocities V, and small electrical resistivities η combine to form large values of the magnetic Reynolds number $R_m = \mu_0 VL/\eta$, a condition in which the plasma and magnetic fields are tightly coupled or 'frozen' together. If the ratio of plasma to magnetic energy density is large, non-uniform motions in such plasmas often stretch magnetic loops or push differentally magnetized regions together into configurations, where magnetic field exhibits large shear, i.e. it changes direction and magnitude rapidly across a narrow electric current sheet. If the ratio is small, the magnetic field organizes the plasma motion instead. And the currents have a tendency to flow along magnetic field lines, a situation that also leads to sheared magnetic fields. All such field configurations contain free magnetic energy. Magnetic reconnection provides a means of converting some or all of this energy to plasma kinetic and thermal energy and thus of changing the field configuration into a thermal equilibrium.

Magnetic reconnection is the process by which magnetic lines of force break and rejoin into a lower-energy configuration. This is considered to be the fundamental process by which magnetic energy is converted into plasma kinetic energy. The Sun has a large reservoir of magnetic energy. The energy released by magnetic reconnection has been invoked to explain both large-scale events, such as solar flares and coronal mass ejections, and small-scale phenomena, such as the coronal and chromospheric microflares that are likely candidates to heat and accelerate the solar wind.

The solar network (chromospheric and photospheric features arranged in a cel-

How do we 'miss the wood for the trees'? Do females have natural flair for lullaby? Cognitive neuroscience tells it all (or does it?)

T. Ramakrishna

Roger Sperry was awarded the 1981 Nobel Prize in Physiology or Medicine for his work on split-brain patients. He showed that in patients whose left and right cerebral hemispheres have been separated (by cutting the 200 million fibres which make up the corpus callosum that connects both the hemispheres), it is the left cerebral hemisphere that processes language whereas the right cerebral hemisphere processes the objects. It was possible to test the functions of each hemisphere

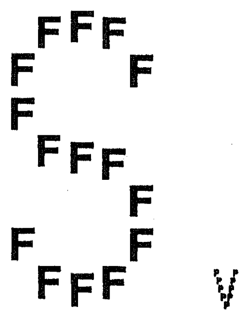

Figure 1. S and V represent global level and F and P, the local level.

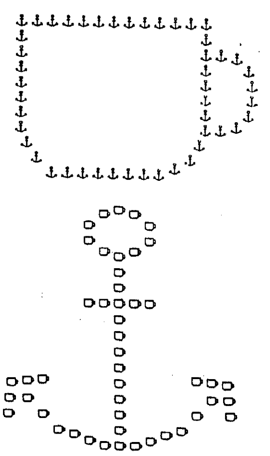

Figure 2. The cup made up of small anchors and the anchor made up of small cups constitute the global level. Small cups within the anchor and the small anchors within the cup constitute the local level.

separately in these patients by showing pictures of objects either through left visual field, thereby feeding this information only to the right cerebral hemisphere (because of the crossing over of the visual information pathways to the contra lateral hemisphere) or vice versa. So long as the picture of any object is registered in the left cerebral hemisphere, the patient would be able to tell the name of the object. However if the picture of the same object is registered in the right cerebral hemisphere, the patient would be unable to tell the name of the object. Through several such ingenious experiments, Sperry was successful in proving that in the majority of the right handers language processing is carried out in the left hemisphere whereas the object processing is done in the right cerebral hemisphere.

This epoch-making discovery in cognitive neuroscience has come to be known as lateralization of hemispheric mechanisms/functions[1].

Cognitive neuroscience has come a long way since the celebrated discovery of Sperry as is evidenced by a special issue of *Science* on cognitive neuroscience very recently[2]. While in the past most neuroscientists focused on individual brain regions and their responses, it is now becoming clear that the processing of information that leads to complex behaviours such as learning and memory involves multiple brain regions operating in interactive and integrated synchrony. The methodology such as the measurement of relative regional cerebral blood flow (rCBF) by recording the regional distribution of cerebral radioactivity following the intravenous injection of ^{15}O-labelled water, known as positron emission tomography (PET scanning), and the functional magnetic resonance imaging (fMRI), made it possible for researchers to examine the responses of distributed brain networks while an individual is performing a task.

Armed with these powerful tools, neuroscientists have given us new knowledge bearing on the questions: (i) How does the brain process global information versus local information, with reference to letters (language) and objects (pictures), and (ii) whether there is any gender-based difference in the brain mechanism(s) for language processing. The first question was dealt with by Fink and his associates at the Institute of Neurology, London and at the Radcliff Infirmary, Oxford[3,4], while the second question was addressed by Shaywitz and his colleagues at the University School of Medicine, New Haven, Connecticut[5].

The perceptual world is organized hierarchically (the forest consists of trees and the trees consist of leaves and so on) and the visual attention can emphasize either the overall picture (global form) or the details within (local components). For example, the letters S and V (Figure 1) used in the experiments by Fink and his colleagues represent the global level and F and P, the local level. Their findings indicate that globally-directed attention involves the right hemisphere and locally-directed attention, the left hemisphere. More specifically, they demonstrated lateralized neural activity in the left prestriate cortex during local processing and in the right prestriate cortex during global processing. In these experiments they used letter-based hierarchical stimuli[3]. In another experiment, they used object-based hierarchical stimuli (Figure 2), wherein, the cup made up of small anchors and the anchor made up of small cups constitute the global level. Small cups within the anchor and the small anchors within the cup constitute the local level. There is now greater right-sided activation of prestriate cortex for local processing and greater left-sided activation for global processing which is the opposite of that seen with the letter-based stimuli of the earlier experiment! The stimulus category (whether letter or