The Complex Functioning of the Human Brain: The Two Hemispheres

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Abstract
The present study reveals just a glimpse of the possible functions and reactions that the human brain can have. I considered as good examples different situations characteristic both of a normal person and a split-brain one. These situations prove that the brain, although divided in two, works as a unit, as an amazing computer that has data processing as a main goal.
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Behavior, from blinking to playing handball or to writing a thesis, depends on the integration of numerous processes within the body. This integration is provided by the nervous system, with the help of the endocrine system.

Consider, for example, all the processes that must be effectively coordinated for a person to stop the car at a red light. First, the person has to see the light, and so neural impulses from the eyes are relayed to the brain, where the stimulus is analyzed and compared with information about past events stored in the memory: the individual recognizes that a red light in a certain context means stopping. Then, the process of moving the foot to the brake pedal and pressing it is initiated by the motor areas of the brain that control the muscles of the leg and foot.

In order to send the proper signals to these muscles, the brain must know where the foot is and also where exactly the person wants to go. The brain maintains a register of the position of body parts relative to one another, which it uses to plan directed movements.

Another amazing thing is that a specialized part of the brain receives continual feedback from the leg and foot muscles so that the driver is aware of how much pressure is being exerted. At the same time, the eyes and some parts of the body transmit how quickly the car is stopping. If the light turned red as the driver was speeding towards the intersection, some of the endocrine glands would also be activated, leading to increased heart rate, a more rapid respiratory rate; all these processes speed the reactions in an emergency. Therefore, stopping at the red light might seem quick and automatic, but it involves many complex messages and adjustments.

One of the most remarkable aspects of the adult nervous system is the human brain. The human brain controls memory, vision, learning, thought, consciousness and other activities. By means of electrochemical impulses the brain directly controls conscious or voluntary behavior. It also monitors, through feedback circuitry, the most involuntary behavior and influences the automatic activities of the internal organs. The brain's billions of neurons connect with one another in complex networks.

All physical and mental functioning depends on the establishment and maintenance of neuron networks. A person's habits and skills become embedded within the brain in frequently activated neuron networks. We can easily admit that the work of the brain is similar to a combination of a computer and a chemical factory. A typical neuron possesses a cell body, dendrites and an axon.

We know the role of neurons in the transmission of nerve impulses, and we know how some neural circuits work; but we are just beginning to unravel their more complex functioning in memory, emotion, and thought [3],[5].

Although at a first impression, the two halves of a human brain look exactly the same, a closer examination reveals asymmetries in appearances and functions. For a normal human being, the brain functions as an integrated whole: information in one hemisphere is immediately transferred to the other by way of a broad network of connecting nerve fibers called the corpus callosum. This connecting bridge can cause a problem in some forms of epilepsy, because a seizure starting in one hemisphere may cross over and trigger a massive discharge of neurons in the other. In order to prevent such seizures in some severe epileptics, neurosurgeons have surgically severed the corpus callosum.

Figure 1 shows the evident differences between the two hemispheres as the sensory inputs appear. With the eyes fixed straight ahead, stimuli to the left of the fixation point go to the right cerebral hemisphere, and stimuli to the right go to the left hemisphere. The left hemisphere controls the movements of the right side of the body, and vice versa. The left hemisphere controls written and spoken language and mathematical calculations. The right hemisphere can understand only simple language and its main ability seems to involve spatial construction and pattern sense [1].

In the normal brain, stimuli entering one hemisphere are rapidly communicated to the other, by way of the corpus callosum, and so the brain functions as a unit. Roger Sperry was interested in split brain persons and he developed several researches in neuroscience. In one of Sperry's test situations, a person who has undergone a split-brain operation is seated in front of a screen that hides his hands from view [4].

First, the word „nut" is flashed briefly on the left part of the screen. With his left hand, the person can easily pick up the nut from a set of objects hidden from his view. At the same time, he can't tell the experimenter what word flashed on the screen since the speech is controlled by the left hemisphere and the visual image of the concept was not transmitted to that hemisphere. When he was questioned, he seemed unaware of what his left is doing. One possible „solution" is that the word should be flashed on the screen for more than one-tenth of a second. This way, the subject can move his eyes so that the word is also projected to the left hemisphere. If the split-brain person can move his eyes freely, information goes to both cerebral hemispheres, and this is one reason for which deficiencies caused by severing the corpus callosum are not readily apparent in a person's daily activities.

This experiment can only prove that the two hemispheres work dependently of each other. They differ in their specializations, but they integrate their activities at all times. Together, the two halves represent an amazing human computer, which processes continuously data, stimuli, representations and emotions. At the same time, a fact is that logical analysis represents only a part of the brain's activity as data processing [3]. After the inputs have been processed at a conscious level, they are transferred to the unconscious mind, which has different mechanisms of data processing. The unconscious re-evaluates the passed experiences of a person, memorizes them, analyzes them and offers solutions to the conscious level. Today's people, being so rationalists, block their unconscious availabilities and this usually leads toward physical or psychological suffering. It is as if they have learned how to constantly have personal boundaries, because this represents normality. Psychotherapy unblocks these boundaries and allows the patient to learn how to be more flexible and creative, working with one's own unconscious resources. This takes time, naturally, but the results are really revolutionary.

I have noticed [2], among students, the same self-limitation and unhappiness and this fact tends to become a real threat to their personal development and to the academic environment as well. Negative emotions come to the surface, both for students and academics, and this can only affect the goals of the educational process. Professors complain about the youngsters as being way too lazy and passive, students blame teachers for their lack of interest in school. It would be much easier for both parts to take into consideration the idea of working with the unconscious potential. People are betrayed by their emotions, as hard as they might fight to repress them. Since we are humans, it is not shameful to reveal emotions, but at the same time emotions can affect our performances – at work or in relationships. Therefore, future researches will focus more on the implications that the human brain's function has upon emotions.

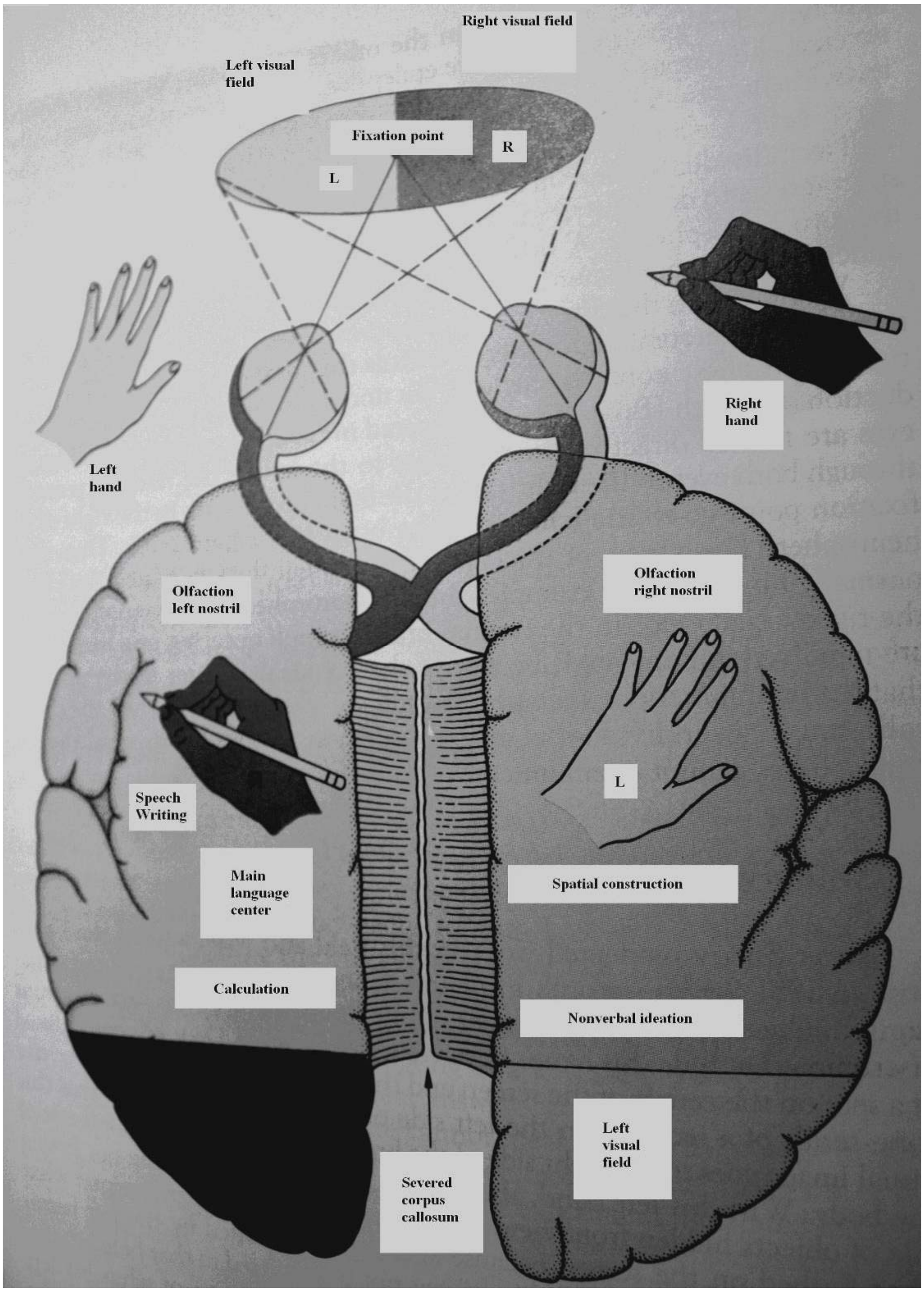

Figure 1 Sensory Inputs to the two Hemispheres (after [1], p. 51)

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