

LANGUAGE

The language area of the brain surrounds the Sylvian fissure in the dominant hemisphere (Figure 32). This area

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des Grosshirns," in *Handbuch der Neurologie* (1910), Springer-Verlag, Berlin

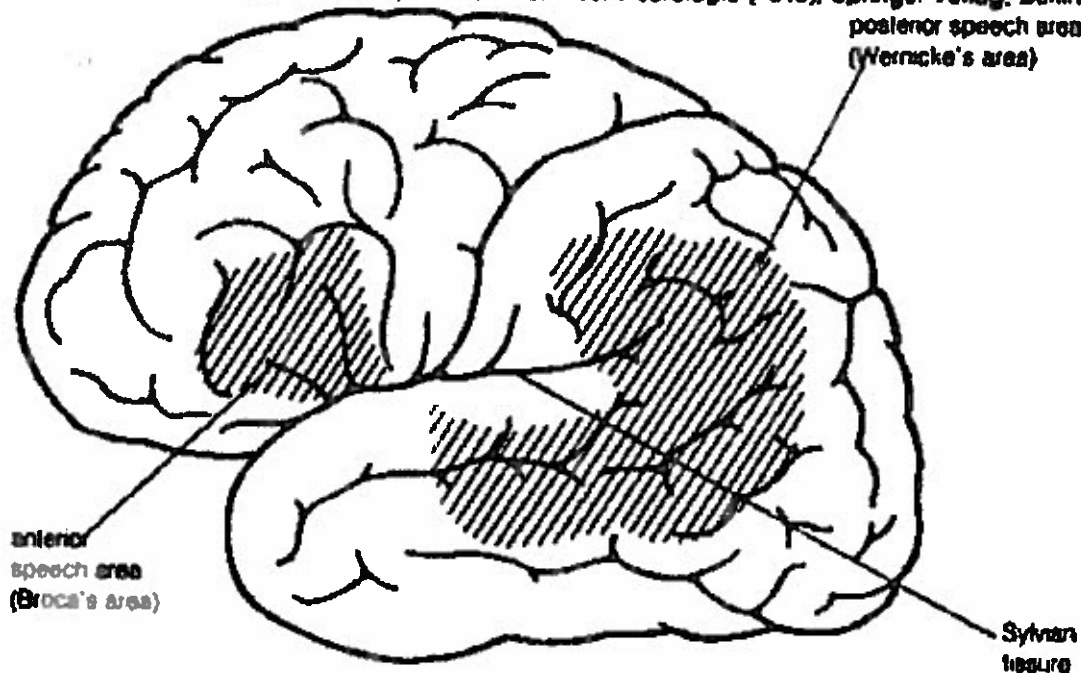


Figure 32: Lateral view of the brain, showing anterior and posterior speech areas (Broca's area and Wernicke's area).

HEMISPHERIC ASYMMETRY, HANDEDNESS, AND CEREBRAL DOMINANCE

Broca's declaration that the left hemisphere is predominantly responsible for language-related behaviour is only the clearest and most dramatic example of an asymmetry of function in the human brain. This functional asymmetry is related to hand preference and probably to anatomical differences, although neither relationship is simple.

Evidence from a number of converging sources, notably the high incidence of the language disturbance known as aphasia after left- but not right-hemisphere damage, indicates that the left hemisphere is dominant for the comprehension and expression of language in close to 99 percent of right-handed people. At least 60 percent of left-handed and ambidextrous people also have left-hemisphere language, but up to 30 percent have predominantly right-hemisphere language. The remainder have language represented to some degree in both hemispheres.

The posterior temporal region of the brain, which in the dominant hemisphere is one of the regions responsible for language, is physically asymmetrical; specifically, the area known as the planum temporale is larger in the left hemisphere in most people. This asymmetry is more common in right-handers, while left-handed individuals are likely to have more nearly symmetrical brains. Reduced anatomical asymmetry has also been found in people with right-hemisphere dominance for speech and in some developmental dyslexics (people with reading disorders). These results point to some relationship between handedness, cerebral dominance for language, anatomical asymmetry in the temporal lobe, and some aspects of language competence. Certainly, there is a tendency for right-handedness, left-hemisphere dominance for language, and a larger left planum temporale to go together. However, there are exceptions; for example, a few right-handers are right-hemisphere dominant for speech, and some right-handers who have left-hemisphere speech do not have a larger left planum temporale. In subjects who are atypical in one of these respects—for example, by being left-handed—the relationship between handedness, cerebral dominance, and anatomical asymmetry is much less consistent. It follows, therefore, that language is not invariably located in the hemisphere opposite the dominant hand or in the hemisphere with the larger planum temporale.

Studies of patients in whom the corpus callosum (the bundle of nerve fibres connecting the two halves of the brain) has been severed, allowing the two hemispheres to function largely independently, have revealed that the right hemisphere has more language competence than was hitherto supposed. These patients show evidence of comprehension of words presented to the isolated right hemisphere, although that hemisphere is not able to initiate speech. The speech of patients with a lesion of the right hemisphere may lack normal melodic quality, and they may have difficulty expressing and understanding such things as emotional overtones. They may also have difficulty appreciating some of the more subtle, connotative aspects of language, such as puns, figures of speech, and jokes. Nevertheless, the dominance of the left hemisphere for language, particularly the syntactic aspects of language and language output, is the clearest example yet discovered of the lateralization of higher cortical function.

The left hemisphere also appears to be more involved than the right in the programming of complex sequences of movement and in some aspects of awareness of one's own body. Thus, the disorders known as ideomotor and ideational apraxia are more common after left-hemisphere damage. In these disorders, the patient has difficulty carrying out actions involving several movements or the manipulation of objects in an appropriate and skillful way. The difficulty appears to be in programming the motor system to run off the sequence of movements required to perform a complex action in the appropriate order and with the appropriate timing.

A third category of deficits associated with left-hemisphere damage, disorder of the body image, is much more difficult to define. It includes a disorder called finger agnosia, in which the individual does not appear to "know" which finger is which, being unable to indicate which one

the examiner touches without the aid of vision. Confusion of right and left is also found after left-hemisphere damage, making it appear that the left hemisphere is largely responsible for collating somatosensory information into a special awareness of the body called the body image. The phenomenon of the phantom limb, whereby patients "feel" sensations in amputated limbs, indicates that the brain's internal representation of the body may persist intact for some time after the loss of a body part. This internal representation appears to be maintained chiefly by the left hemisphere.

The special functions of the right hemisphere were recognized later than those of the left hemisphere, although a case of "impercception" reported by the English neurologist John Hughlings Jackson in 1876 foreshadowed later findings. Jackson's patient, who had a lesion in the posterior part of the right hemisphere, lost her way in familiar surroundings, failed to recognize familiar places and people, and had difficulty in dressing herself—all of which became well-recognized consequences of right-hemisphere damage. The right hemisphere, then, appears to be specialized for some aspects of higher-level visual perception, spatial orientation, and route finding (sense of direction), and it probably plays a dominant role in the recognition of objects and faces. The specialization of the right hemisphere, however, is less absolute than that of the left hemisphere in that these skills are less lateralized than language.

There has been considerable speculation as to why the human brain should be functionally asymmetrical. Initially, both functional and anatomical asymmetry were thought, like language, to be a uniquely human trait, but less pronounced asymmetries have now been found in lower animals. One suggestion is that it is necessary to have language represented in a single hemisphere to avoid competition between the hemispheres for control of the muscles involved in speech. Another suggestion is that it is efficient to have the language system represented in a restricted area on one side of the brain because information needs to be transferred over short distances and fewer connections. A third suggestion is that the dominance of the left hemisphere over the right hand and skilled movement preceded its dominance over language. According to this view, language subsequently developed in the same hemisphere because language implies speech, which requires precise programming of sequences of movement in the articulatory musculature. All these views have something to recommend them, but none has been conclusively proved correct or has been generally accepted. Also, there remain some facts that are difficult to explain by any theory. For example, all the above theories would predict that bilateral and, in some cases, right-hemisphere language representation would be disadvantageous, but this does not seem to be generally true.

Specialized functions of the right hemisphere

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(Data) From C.D. Clements (ed.), *Gray's Anatomy of the Human Body*, 30th ed. (1965). Lee and Feigler, after Walter Penfield and Lamar Roberts, *Speech and Brain Mechanisms*, copyright © 1959 by Princeton University Press, Fig. X-4 reproduced with permission of Princeton University Press. (art. reproduced by permission of Catherine Parker Anthony and Gary A. Thibodeau, *Textbook of Anatomy & Physiology*, 12th ed. (1987), Times Mirror/Mosby College Publishing, St. Louis, adapted from K. Brodmann, "Feststellung der Grosshirnareale," in *Handbuch der Neurologie* (1910), Springer-Verlag, Berlin.

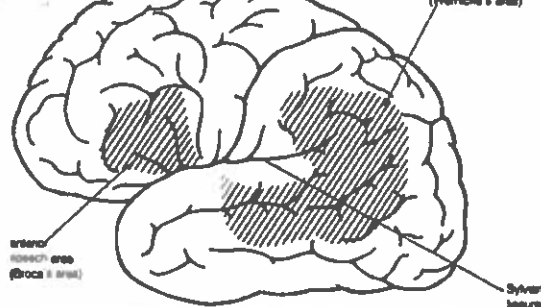
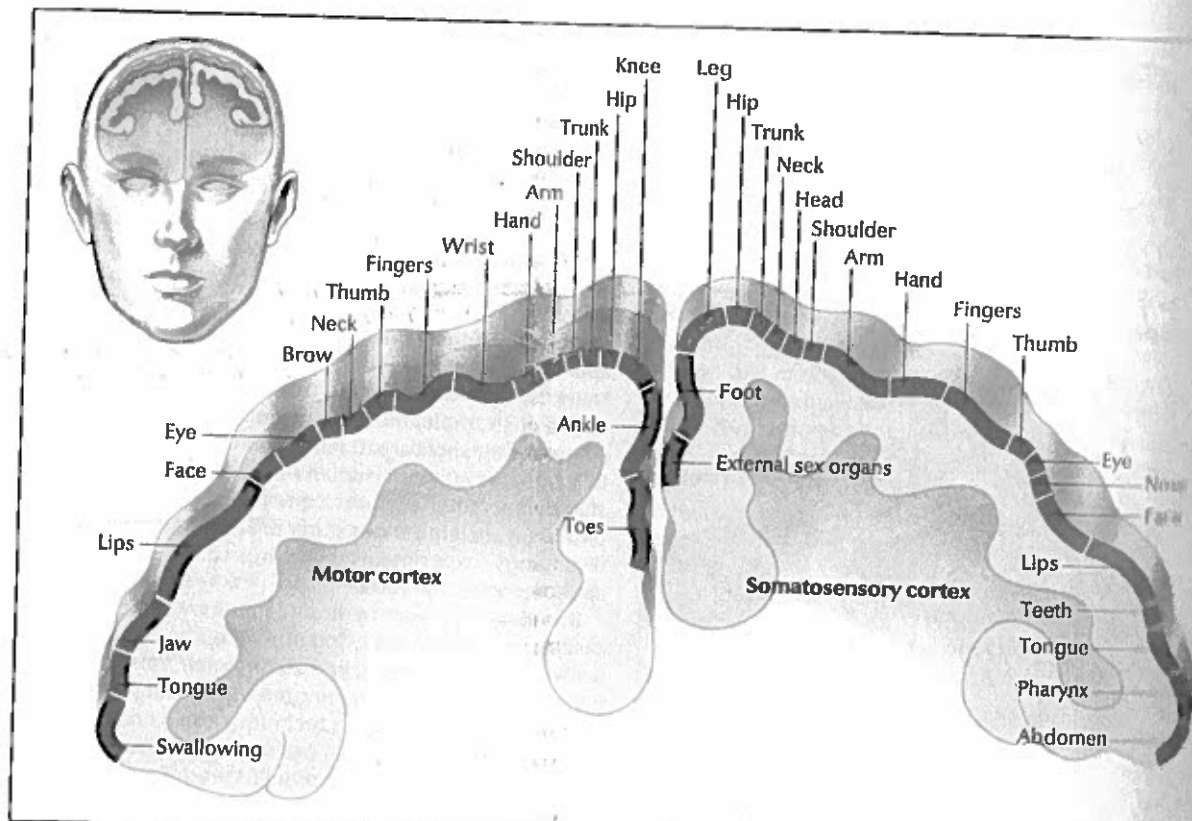


Figure 32: Lateral view of the brain, showing anterior and posterior speech areas (Broca's area and Wernicke's area).



Regions of the motor and somatosensory cortices are linked to specific parts of the body. The motor cortex is involved in the control of movement. Its largest areas correspond to the parts of the body that make the most complex voluntary movements. The somatosensory cortex receives sensory information from the body. Its largest areas correspond to the most sensitive body parts.

WORLD BOOK diagram by Colin Bidgood and Barbara

members and imagines events, (5) regulates emotions, (6) controls attention and consciousness, (7) makes decisions, and (8) produces language.

Sensing the environment. Various parts of the body send sensory messages to the brain in the form of nerve impulses. These messages are received and interpreted primarily in the cerebral cortex. For example, the back of the eye contains cells that detect light. These cells stimulate nerve fibers that join at the back of the eye to form the *optic nerve*. The optic nerve carries signals from the light-sensing cells to certain regions of the cerebral cortex. The cortex interprets the signals as visual images.

Cells in other parts of the body specialize in detecting pain, smell, sound, taste, temperature, and touch. Some sense blood pressure and blood chemistry. Others detect the stretching and tension of muscles. All of these sensory cells send nerve impulses along nerves to the brain or spinal cord. Through the nerves, the brain receives an enormous amount of information about environment inside and outside the body.

Within the brain, sensory information flows from neuron to neuron along multiple pathways. Some of these pathways go to the brain stem. There, sensory information is used to adjust basic functions, such as heart rate, breathing, and posture. Other neuron pathways go to the cerebellum, which helps to fine-tune adjustments made by the brain stem. Many pathways carry sensory information to the cerebrum, where it is used to control more complex behaviors.

Messages related to bodily sensations, such as touch and temperature, are received and interpreted in an area of the cerebrum called the *somatosensory cortex* (*SOM muh tuh SEHN suhr eel*). The somatosensory cortex lies near the front of the parietal lobe in each hemisphere. Different areas of the cortex process information from different parts of the body, with information from neighboring body parts usually processed in neighboring areas of the cortex. Certain parts of the body have more sensory cells than other areas. More neurons are required to process information from these sensitive parts. For example, about half of the neurons in the somatosensory cortex process sensory impulses from the hands and face. These sensitive areas have the highest density of touch sensors.

The same sensory information can follow multiple neuron pathways within the cerebrum, each dedicated to a different purpose. Neuroscientists learned this by studying patients who suffered brain damage. Upon looking at a photograph of an object, for example, some brain-damaged patients can tell a person where the object is, but they cannot tell the person what the object is. This fact suggests that the two tasks involve different neuron pathways.

Even though various types of sensory information are processed in different parts of the cerebrum, we experience the world as a unified whole. Neuroscientists have wondered how this is possible. Most of them think the connections between neurons in different areas of the

y-5



USA FOREVER

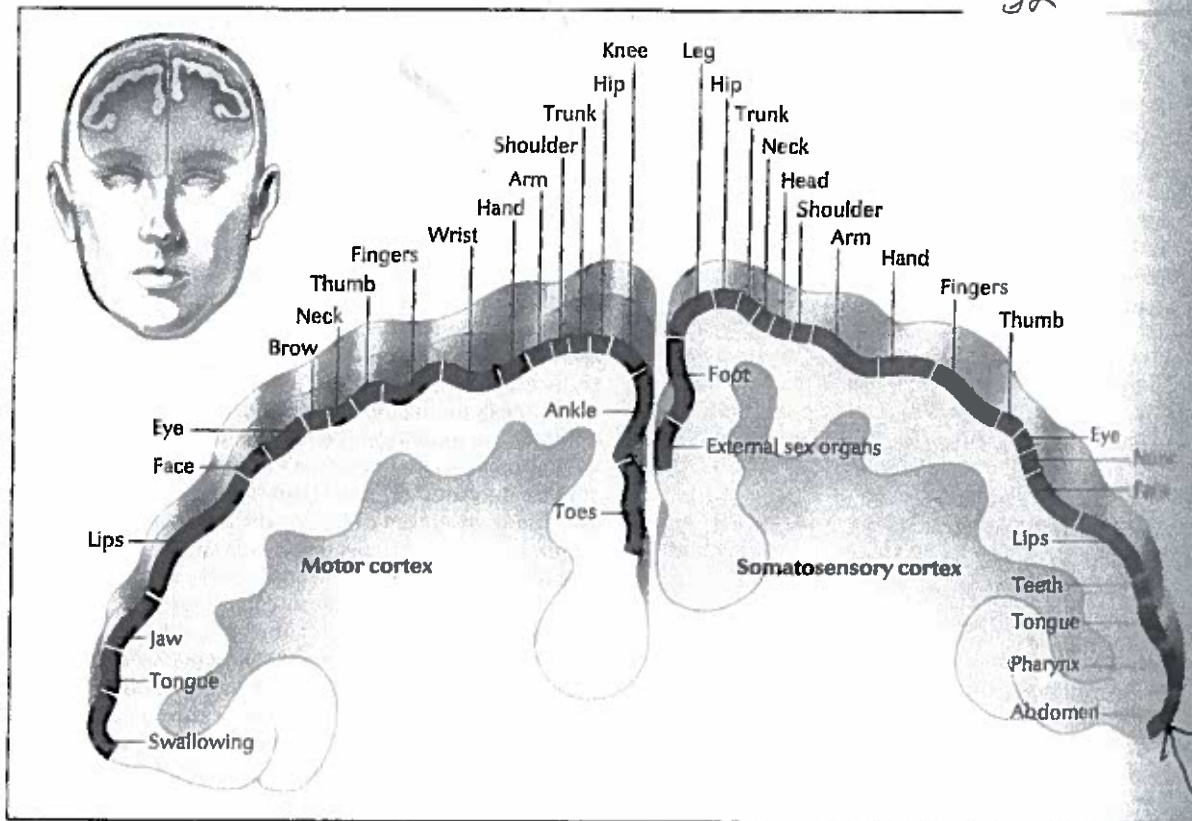
The Artists' obsession with brain is so everywhere that the new postcards sneakily idea-of-reference one, like in the view below. The way that Mr. [redacted] type "grows" offspring has been like "egg-drop soup," where

a "found" ovary is dropped into a group-ejaculation bin or basin or whatever and then they use ones that don't turn out well for food. I suspect that that space like this one

that's on the tree as a white

552 Brain

32



Regions of the motor and somatosensory cortices are linked to specific parts of the body. The motor cortex is involved in the control of movement. Its largest areas correspond to the parts of the body that make the most complex voluntary movements. The somatosensory cortex receives sensory information from the body. Its largest areas correspond to the most sensitive body parts.

WORLD BOOK diagrams by Colin Blagden and Barbara

separated space, like between the neocortex on top and the rest of the brain, in this "bingo-ball genetics" sometimes doesn't match and fit correctly and makes misconnections of input that lead to the violence.

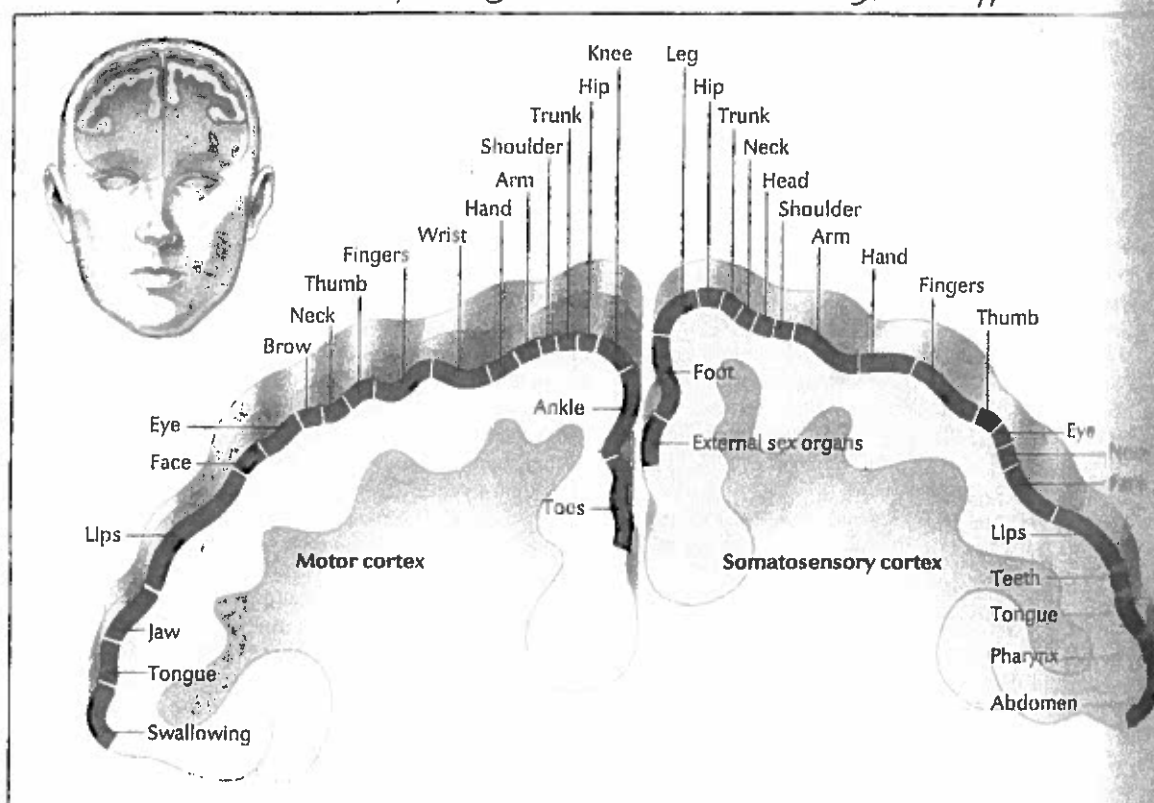
The new little postcards have a tree picture, enlarged here,
 that looks suspiciously
 like a brain,
 as this LSD-obsession
 is everywhere,
 me at the
 bottom of the
 Armageddon
 by the
 hallucinogen-
 dependant
 Artists, and
 their friends.



USA FOREVER

552 Brain

my main point is that Mr. Foshay has an insane-temper
 for the button-pushing for missiles-throwing, his type does.



Regions of the motor and somatosensory cortices are linked to specific parts of the body. The motor cortex is involved in the control of movement. Its largest areas correspond to the parts of the body that make the most complex voluntary movements. The somatosensory cortex receives sensory information from the body. Its largest areas correspond to the most sensitive body parts.

Please let me have a little more time to fix up this on
 the Autism, — not "fix," but to explain the meat and hallucinogen misunderstandings,
 before their partners give me a phony-COPD again!

Sincerely, Kathy Foshay

Broca's
and
Wernicke's
language
areas

is divided into two major components named after the pioneers Paul Broca and Carl Wernicke. Broca's area lies in the third frontal convolution, just anterior to the face area of the motor cortex and just above the Sylvian fissure. This is often described as the motor, or expressive, speech area; damage to it results in Broca's aphasia, a language disorder characterized by deliberate, telegraphic speech with very simple grammatical structure though the speaker may be quite clear as to what he wishes to say and may communicate successfully. Wernicke's area is in the superior part of the posterior temporal lobe; it is close to the auditory cortex and is classically considered to be the receptive language, or language comprehension, centre. A patient with Wernicke's aphasia has difficulty understanding language; his own speech is typically fluent but is empty of content and characterized by circumlocutions, a high incidence of vague words like "thing," and sometimes neologisms and senseless "word salad." The entire posterior language area extends into the parietal lobe and is connected to Broca's area by a fibre tract called the arcuate fasciculus. Damage to this tract has been implicated in conduction aphasia, a disorder in which the patient can understand and speak but has difficulty in repeating what is said to him. The suggestion is that, in this condition, language can be comprehended by the posterior zone and spoken by the anterior zone, but it can not be easily shuttled from one to the other.

Distinction
between
aphasia
and
apraxia

It is important to note that aphasia is a disorder of language and not of speech (although an apraxia of speech, in which the programming of motor speech output is affected, may accompany aphasia). The writing and reading of aphasic patients, therefore, usually commits the same type of error as their speech, while the reverse is not the case. Isolated disorders of writing (dysgraphia) or, more commonly, reading (dyslexia) may occur as well, but these reflect a disruption of the additional processing required for these activities over and above that required for language.

One particular form of dyslexia deserves mention, as it is a clear example of a disconnection syndrome—a disorder resulting from the disconnection of two areas of the brain rather than from damage to a "centre." This is dyslexia without dysgraphia, or letter-by-letter reading, so called because it is not associated with writing disturbance and because the patients tend to attempt to read by spelling words out loud letter by letter. It usually results from a lesion in the posterior part of the left hemisphere that disconnects the visual areas of the brain from the language areas. This renders the language areas effectively blind, so that they cannot be brought to bear on visible language such as the written word. Writing is unaffected because the right hand is still connected to the left hemisphere, and, if letters can be spoken out loud correctly (which is not always the case), the patient will be able to hear himself say them and reintegrate them into words. Disconnection syndromes are an important concept in understanding behavioral disorders associated with brain damage. The possibility that deficits are caused by disconnection must always be borne in mind.

MEMORY

Memory is one of the most widely studied cognitive functions, and a number of different aspects of memory are recognized. The labels short-term memory, primary memory, and working memory refer to the temporary storage of information that is necessary for the performance of many cognitive tasks. In order to understand this sentence, for example, a reader must maintain the first half of the sentence in working memory while reading the second half. This working memory has been graphically described as the memory one uses to hold a telephone number in mind after looking it up in a directory and while dialing. The capacity of working memory is limited, and it decays if not rehearsed. Long-term memory, secondary memory, and reference memory refer to the storage of information for longer periods. The capacity of long-term memory is very large—in practice unlimited—and it can endure indefinitely. In addition, psychologists distinguish episodic memory, a memory of specific events or episodes

normally described by the verb remember, from semantic memory, a knowledge of facts normally said to be learned rather than remembered.

Almost certainly, memory is stored over wide areas of the brain rather than in any single location. However, amnesia, a disorder of memory, can occur after localized bilateral lesions in the limbic system—namely the hippocampus on the medial side of the temporal lobe, some parts of the thalamus, and their connections. This probably implies that these structures, rather than the hippocampus, constitute a memory store, are important in the laying down of memories and in their recall when needed. Memory impairment resulting from damage in these areas is a disorder of long-term episodic memory and is properly named an anterograde amnesia—that is, it typically affects the memory of events occurring after the illness or accident causing the amnesia more than it does memories of the past. Substantial retrograde amnesia (loss of the memory of events occurring before the onset of amnesia) rarely if ever occurs without significant anterograde amnesia as a result of brain damage, although it may occur alone in psychiatric illness.

Although amnesia is a disorder of long-term episodic memory and leaves short-term and semantic memory intact, both of the latter can be affected by brain damage. Some parietal lobe lesions may affect short-term memory without affecting long-term memory; this fact has contributed to a revision of the old theory that there are distinct short- and long-term stores, the latter being accessible only via the former. It has been suggested that short-term memory impairment—at least for verbal material—can be further subdivided into auditory and visual domains; however, these disorders manifest themselves as difficulty in understanding spoken and written language rather than in memory impairment (i.e., they appear more like aphasia and dyslexia). Impairment of semantic memory, too, results in an impairment that resembles a loss of concepts or a language deficit more than it resembles what would usually be described as a memory impairment. Some forms of visual agnosia have been interpreted as semantic memory impairment, since the patients are unable to recognize objects such as chairs because they no longer "know" what chairs are or what they look like (they can no longer access that knowledge).

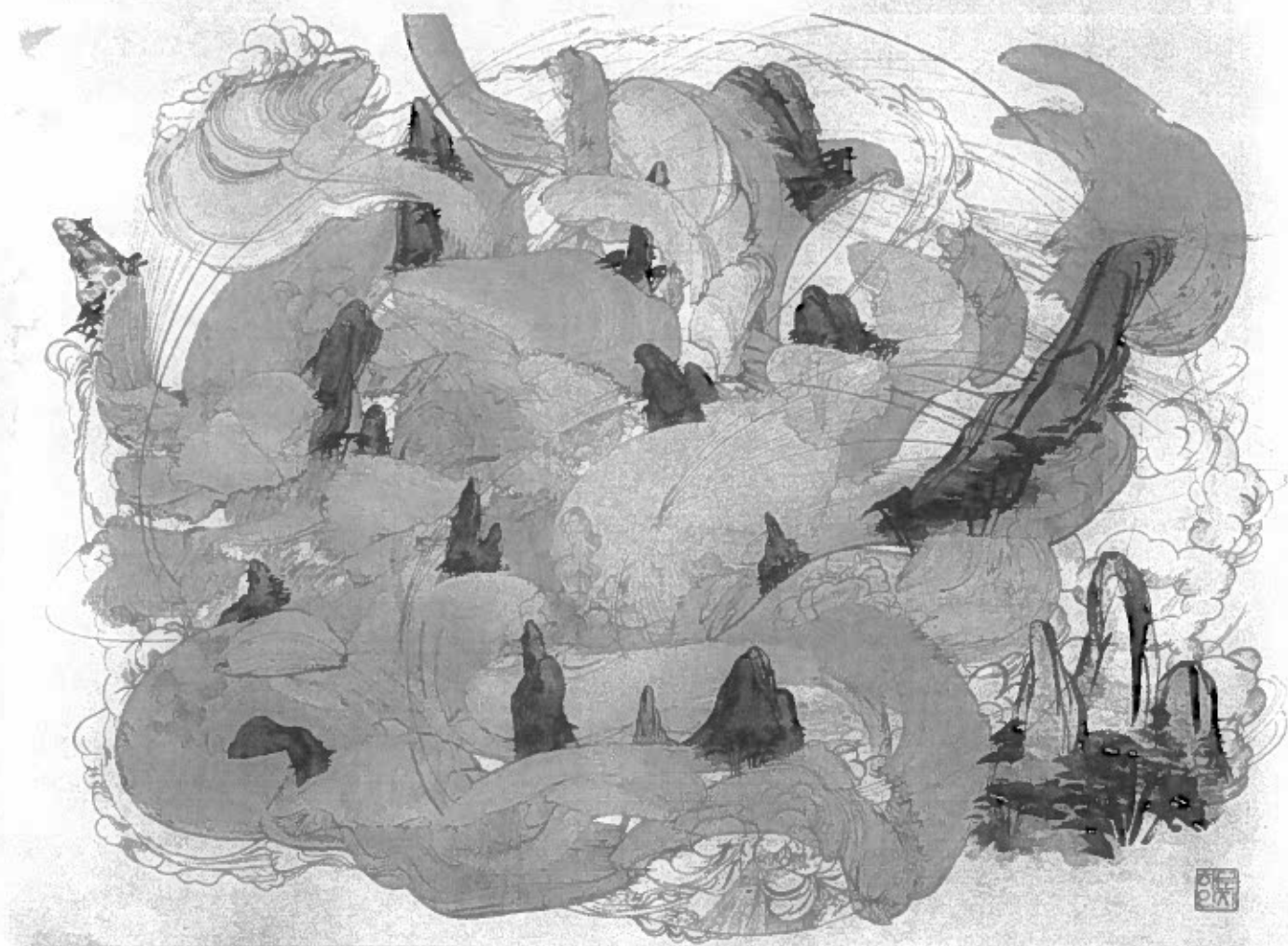
EXECUTIVE FUNCTIONS OF THE FRONTAL LOBES

The frontal lobes are the part of the brain most removed from sensory input and whose functions are most difficult to capture. They can be thought of as the executive that controls and directs the operation of the brain systems dealing with cognitive function. Indeed, the deficits seen after frontal lobe damage have been described as a "disexecutive syndrome."

Frontal lobe damage can affect people in any of several ways, and the results are at once subtle and drastic. On the one hand, they may have difficulty initiating behaviour, in extreme cases being virtually unable to move or speak but more often simply having difficulty in getting started on a task. On the other, they may perseverate, being apparently unable to stop a behaviour once started. Rather than appearing apathetic and hypoactive, they are uninhibited, rude, and boorish. Such people may also have difficulty in planning and problem solving and may be incapable of creative thinking. Mild cases of this deficit can be revealed by a difficulty in solving mental arithmetic problems that are couched in words, even though it can be shown that the patient is capable of remembering the question and performing the required calculation. In such cases it appears that the patient simply cannot work out what to do, a difficulty described as a failure to select the appropriate cognitive strategy.

A unifying theme in these disorders is the notion of inadequate control or organization of pieces of behaviour that may in themselves be well formed. Frontal lobe patients are easily distracted. Although their deficits may be superficially less dramatic than those associated with posterior lesions, they can have a drastic effect on everyday function. Irritability and personality change are also frequently seen after frontal lobe damage.

(G.Ra.)



Jiha Moon | Air Cartography, ink/acrylic/pen | 23W x 29H

I found this in a book about art in the City Hall John A. Wilson Building. To me it represents that a brain with the Autism-psychopathy has these "invisible dinosaurs" from guilt over accidentally extinguishing the dinosaurs by methodically smashing the baby-eggs.

Today's underground "food-way" is from covering-up about that "war" and I've been trying to explain that admitting about the errors in Prehistory is the only way to get things repaired so to not become extinct by this bizarre stop-gap system of fertilizing disembodied ovaries.