

# Neuropsychological assessment

## Luria's theory

- Cognitive process is dynamic functional system.
- Functional system consist of interconnected subprocesses, or components

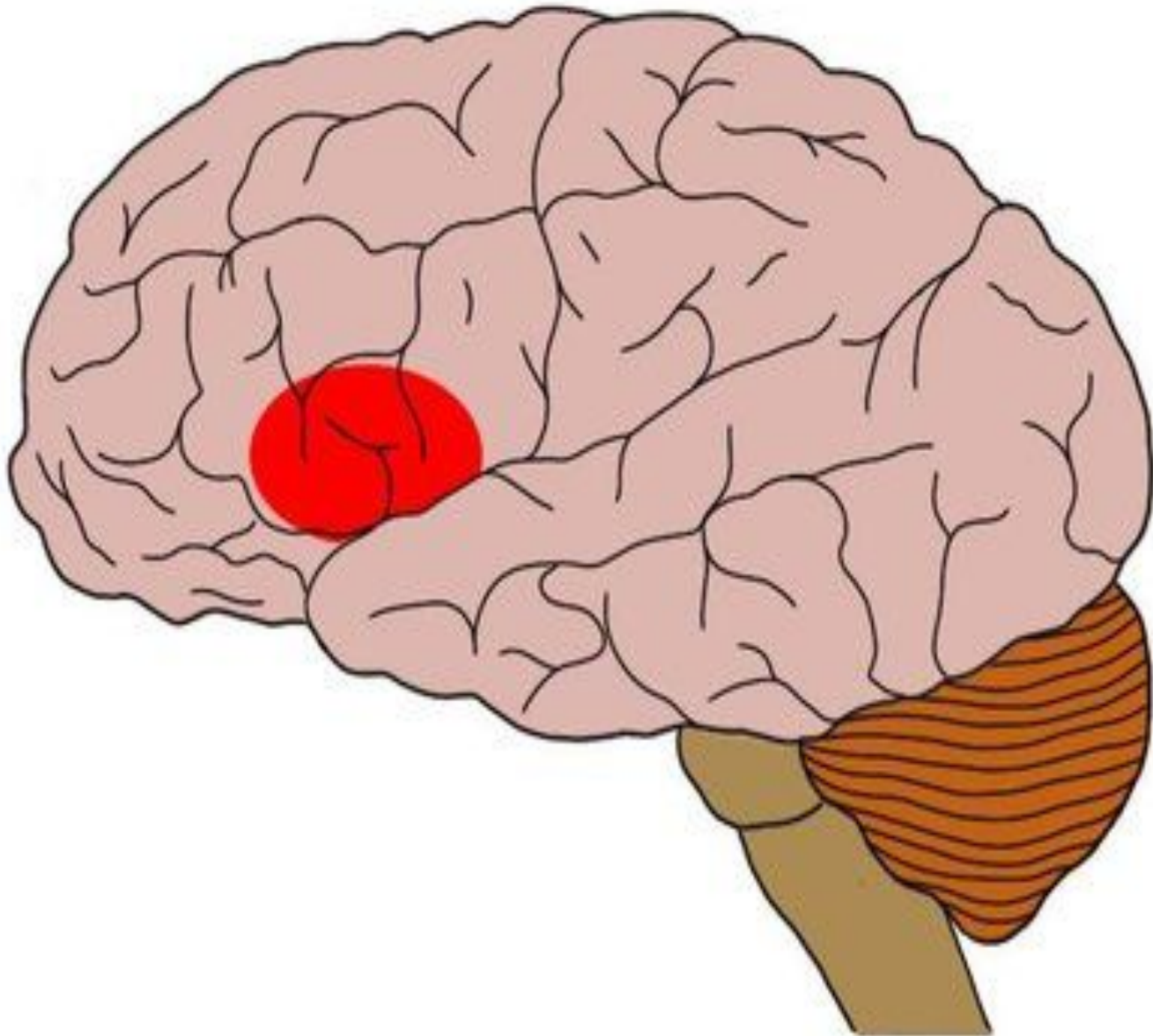


# Functional system

**Expressive language** include at least the following components:

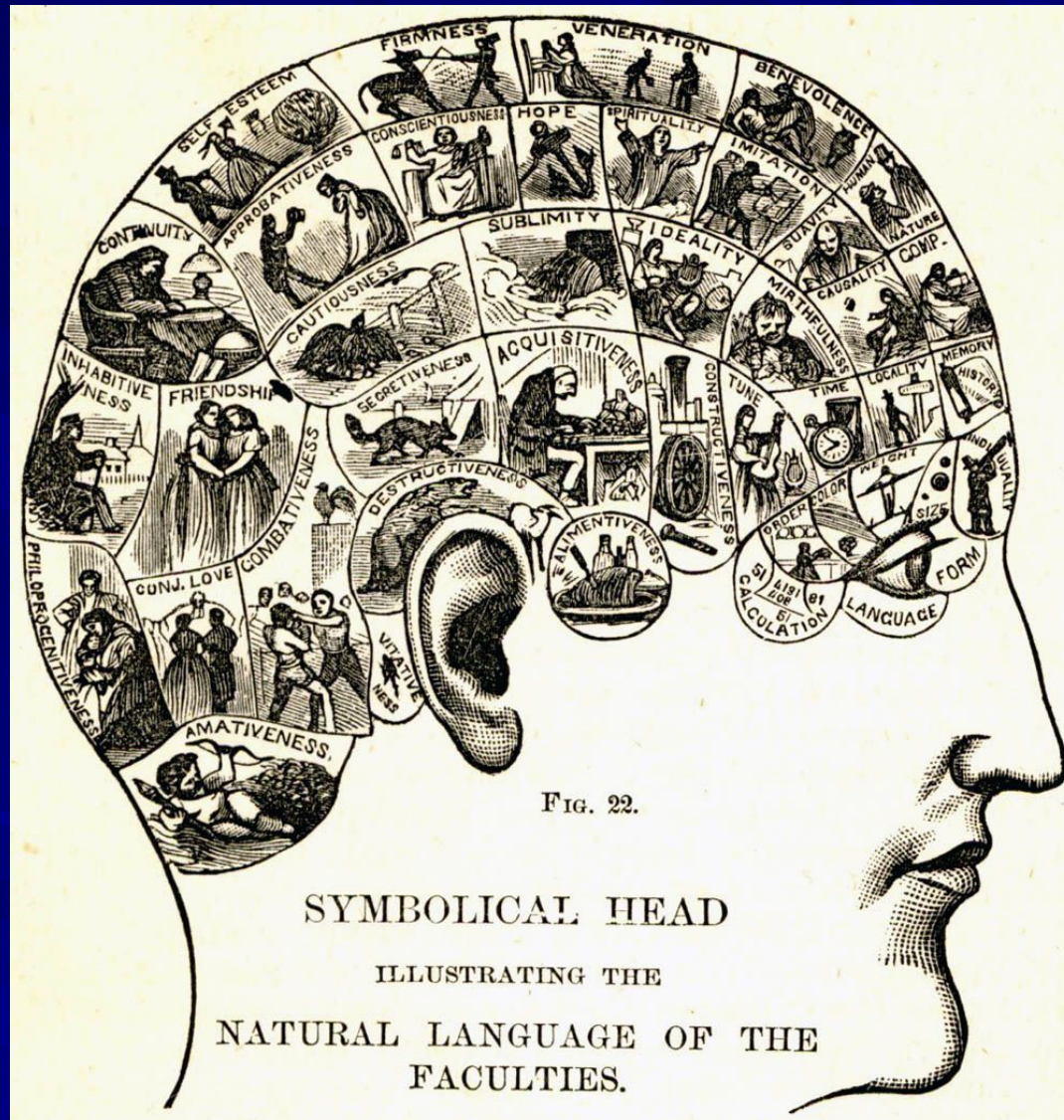
- inner speech
- producing a articulatory poses
- switching from one articulatory pose to another (oral articulatory motor series)
- kinesthetic feedback from articulatory movements
- auditory phonemic analysis of speech
- working memory

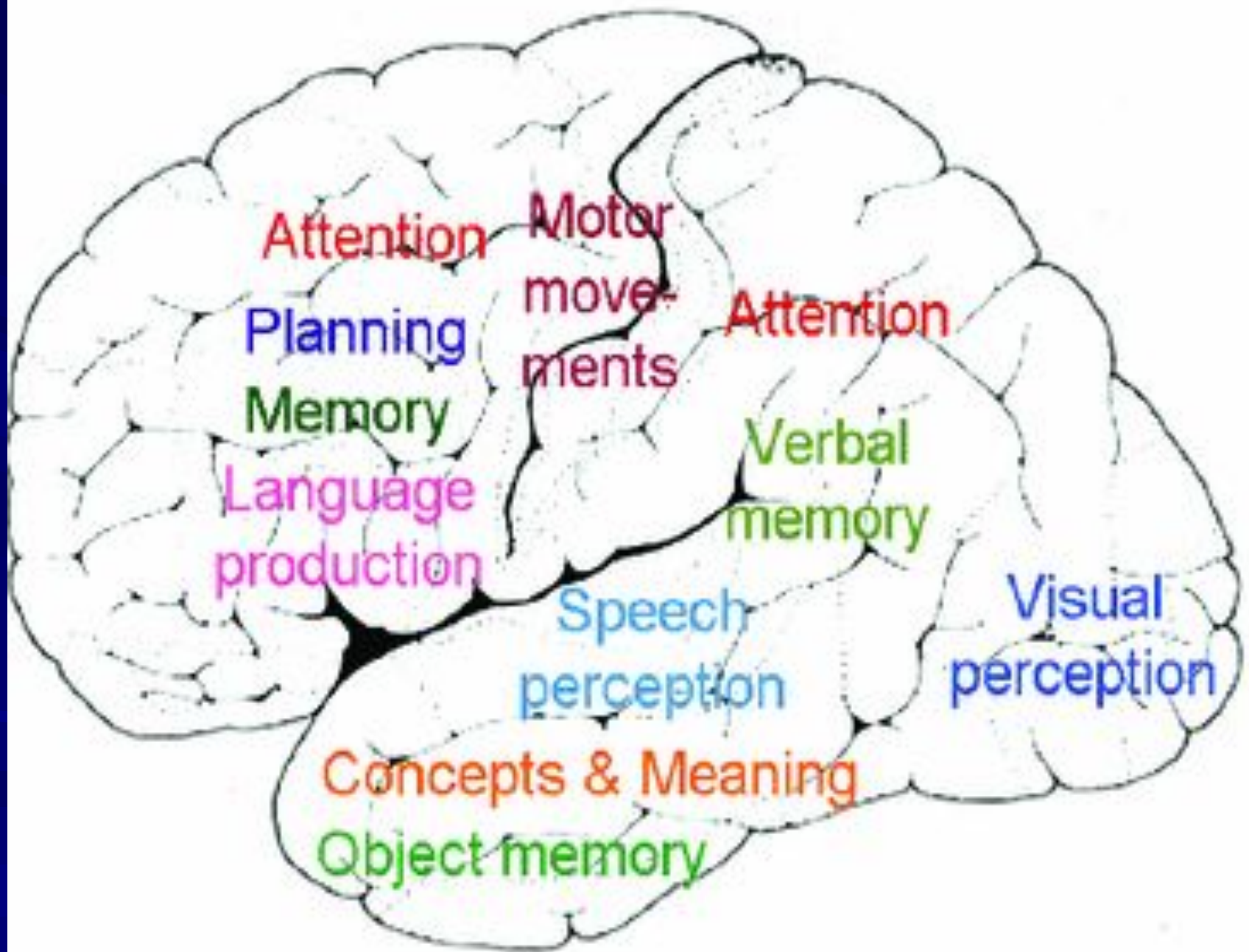
## Broca's area



# Phrenology

Franz Joseph Gall (1758-1828)

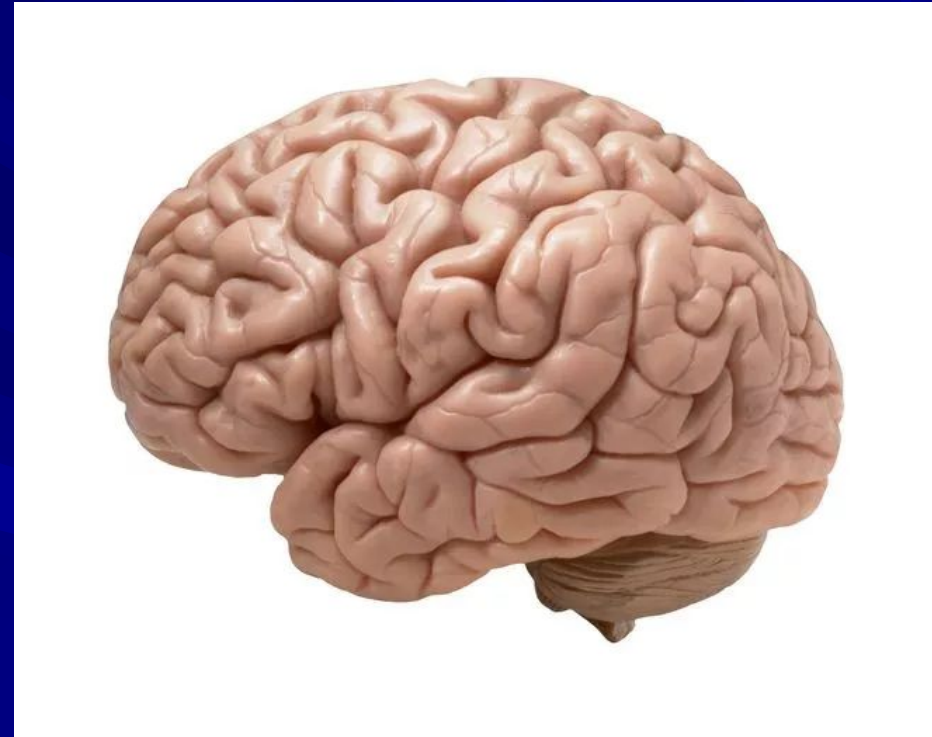




# Luria's theory

Physiological process  
(neuronal activity)

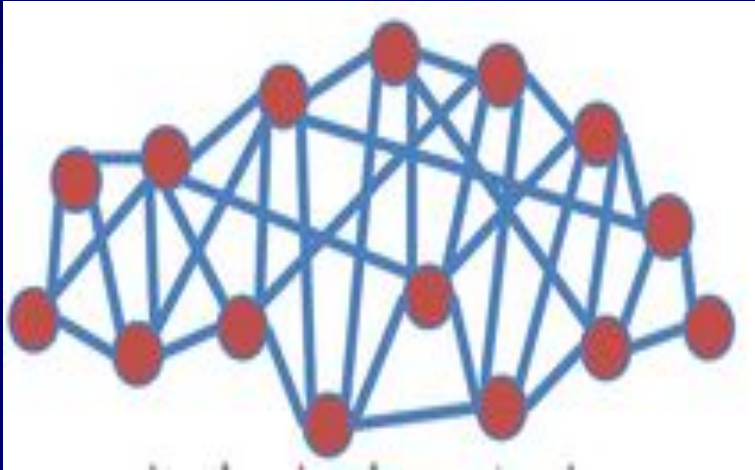
Mental process



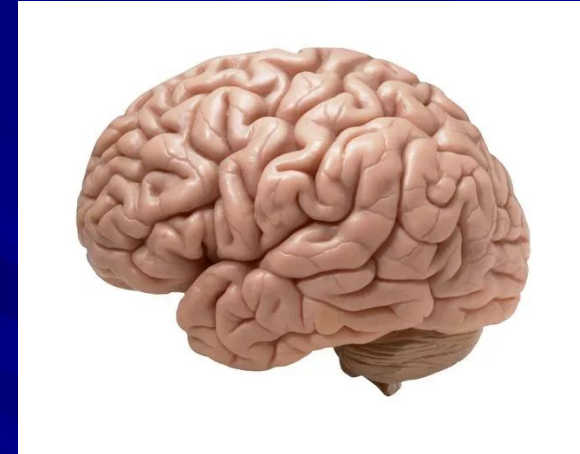
The components of the functional systems reflect the activity of specific brain regions.

# Luria's theory

Psychological process



Physiological process



Neuropsychological  
factors

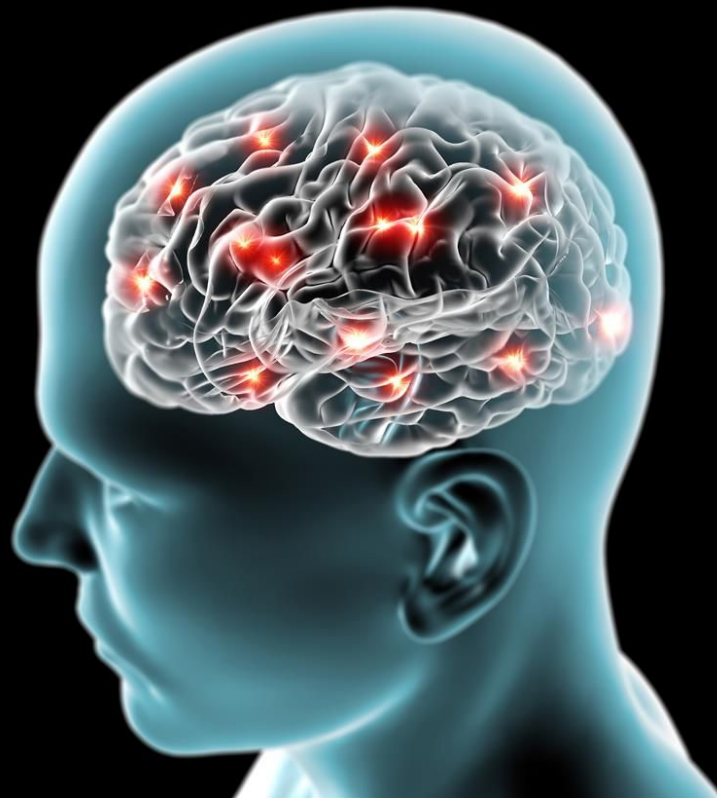
(Specific  
brain  
Mechanisms)

**Neuropsychological factor** is  
a specific brain mechanism  
that contribute to a specific  
component of functional  
system



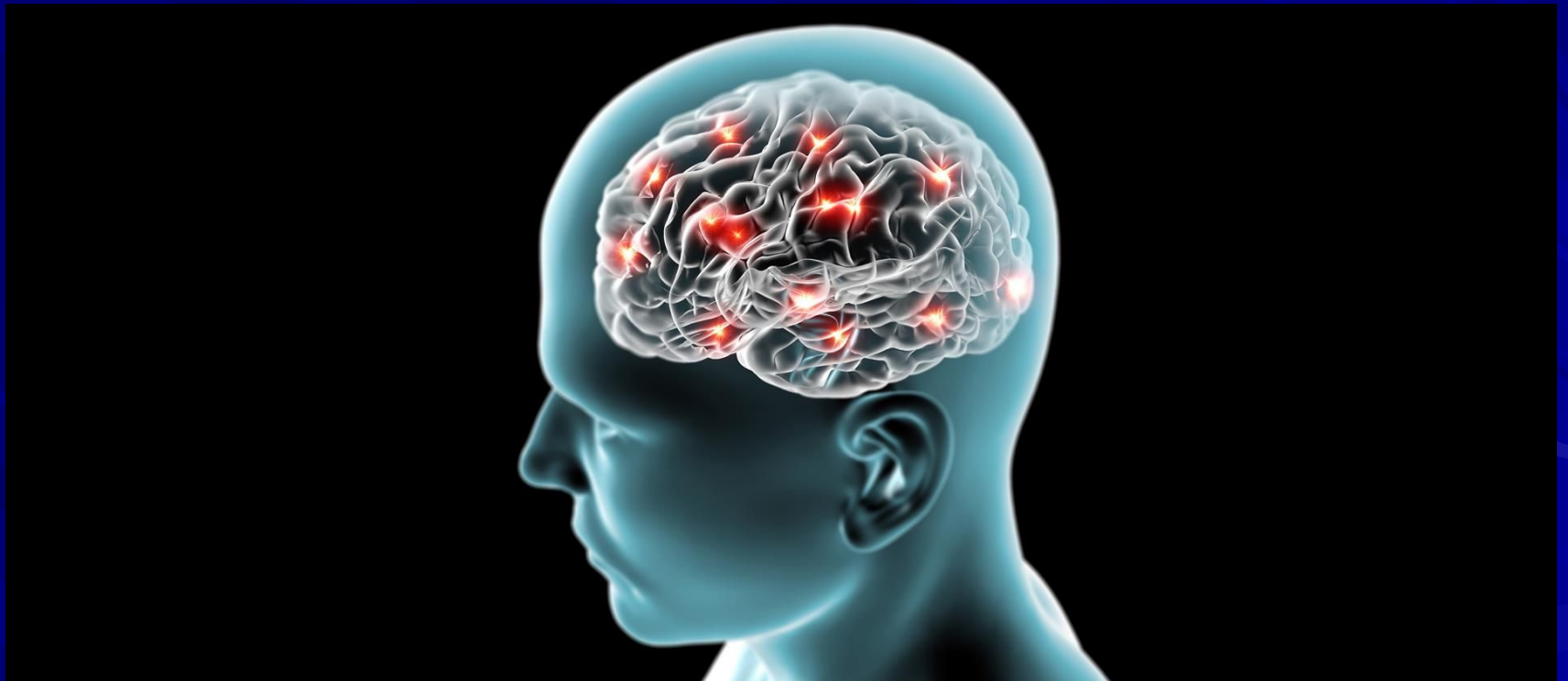
## The basic concept of Luria's theory

The brain is "a functional mosaic" of specific  
neuropsychological factors



## The basic concept of Luria's theory

Various combinations of **specific neuropsychological factors** provide the neural basis of cognitive processes



# Dysgraphia

deficiency in the ability to write

Component of functional system	Symptoms	The role in writing	Brain area	Brain mechanism
Visual image of letter	Substitutions of visually similar letters	Visual analysis of details in letters	Visual cortex	Visual information processing
Visuospatial image of letter				

# Dysgraphia

## Component of the Functional System

### 1. Visual image of letter

q g

# Dysgraphia

## Symptoms and compensations

Substitutions of visually similar letters

quick – quick

Compensation

the use of kinaesthetic analysis of graphic movements

# Dysgraphia

## The role in writing

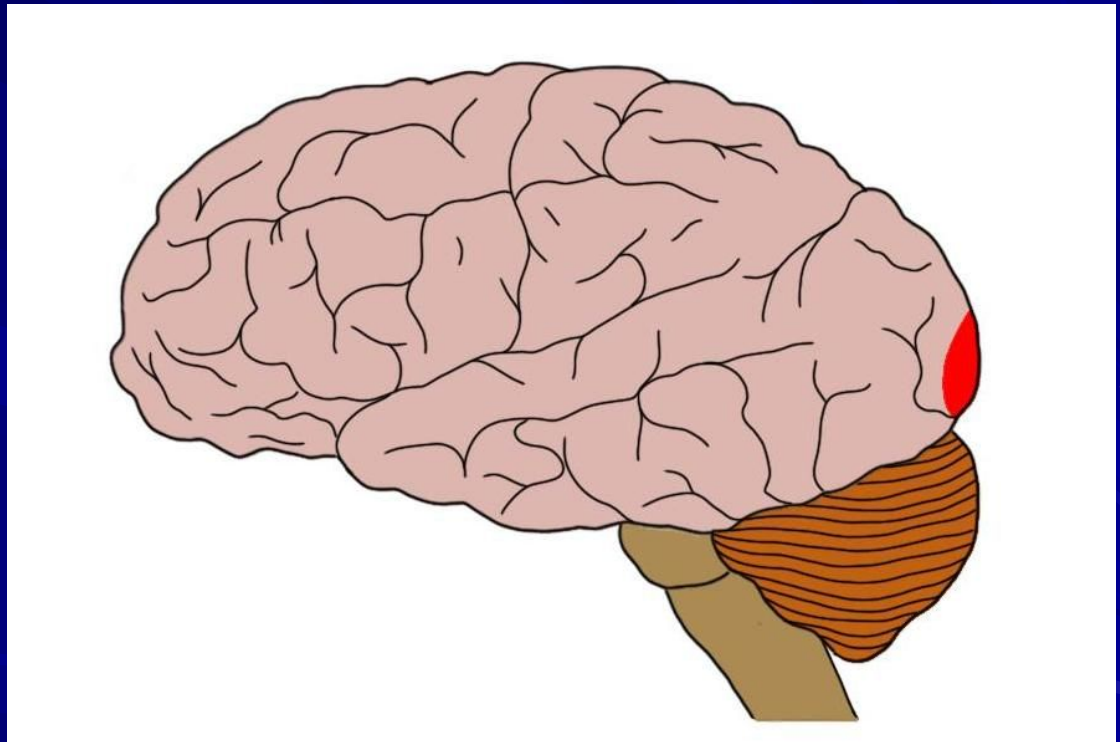
Visual analysis of  
details in letters

## Brain area

Visual cortex  
(occipital lobe)

## Brain mechanism

Visual information  
processing



# Dysgraphia

## Component of the Functional System

### 2. Visuospatial image of letter

b d q

# Dysgraphia

## Symptoms

Mirror writing

dog

bog





# Dysgraphia

## The role in writing

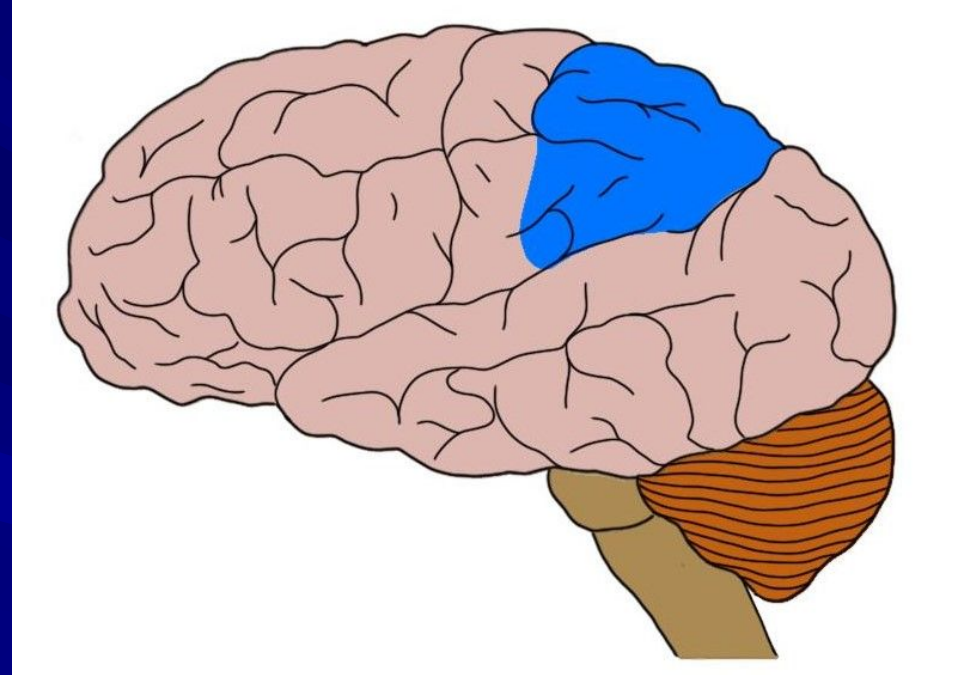
Visual analysis of letters which have only visuospatial differences

## Brain area

Posterior-parietal associative cortex  
(parietal lobe)

## Brain mechanism

Visuospatial information processing



# Dysgraphia

## Component of the Functional System

### 3. Motor component

Afferent part

Efferent part



# Dysgraphia


Afferent part

Symptoms and compensations

Clumsy writing

**Figure 3. Molly's free writing. She was asked to write but did so with great reluctance .**

I went to the caravan  
and took Beegis for a  
walk  
in the  
Wood



# Dysgraphia

Afferent part

Symptoms and compensations

*Compensation*

big letters



# Dysgraphia

## The role in writing

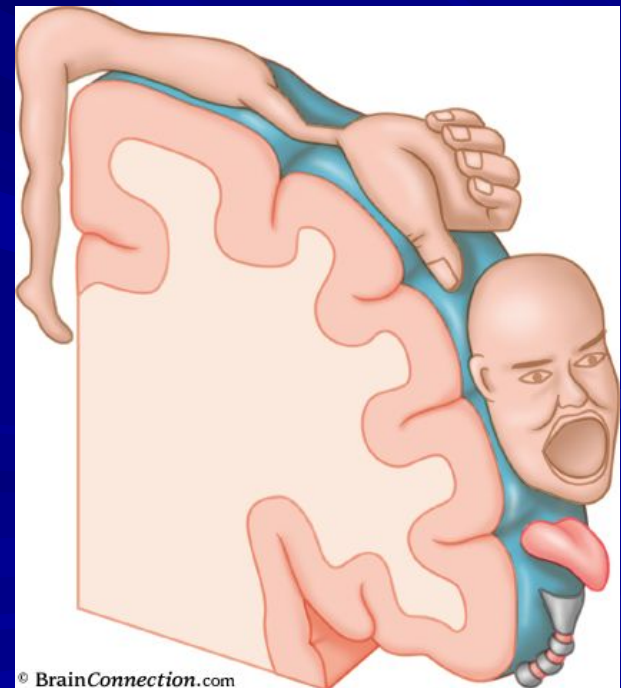
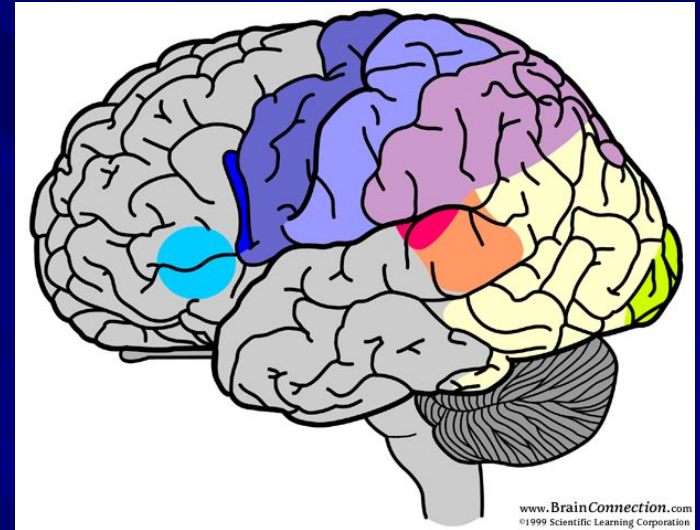
Kinaesthetic analysis of graphic movements (motor schema corresponding to the image of the letter).

## Brain area

Somatosensory cortex  
(hand/wrist area)

## Brain mechanism

Kinaesthetic information  
Processing



# Dysgraphia

Component of the Functional System

**Motor component**

Efferent part



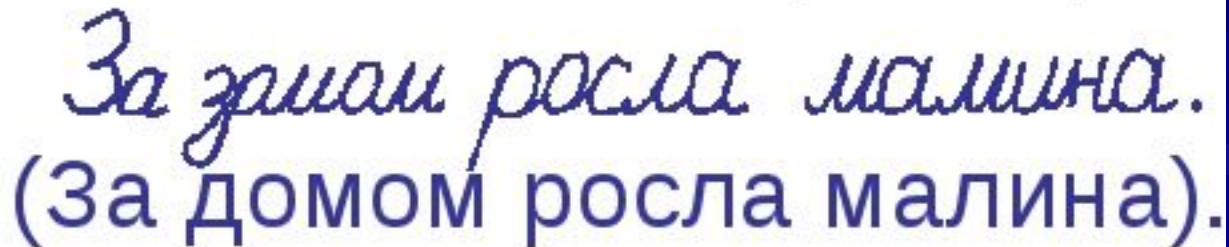
# Dysgraphia

Efferent part

Symptoms and compensations

Perseverations of elements in letters or letter

Velvet - Wellvet



За зршом росла малина.  
(За домом росла малина).

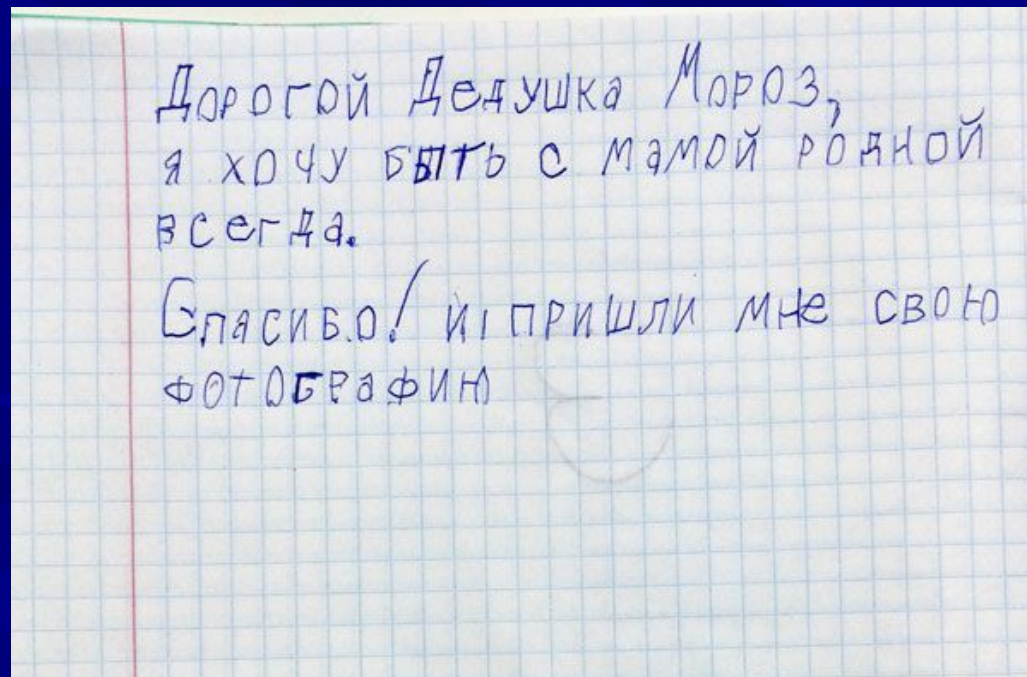
# Dysgraphia

## Efferent part

### Symptoms and compensations

#### *Compensation*

writing in printed letters





# Dysgraphia

## The role in writing

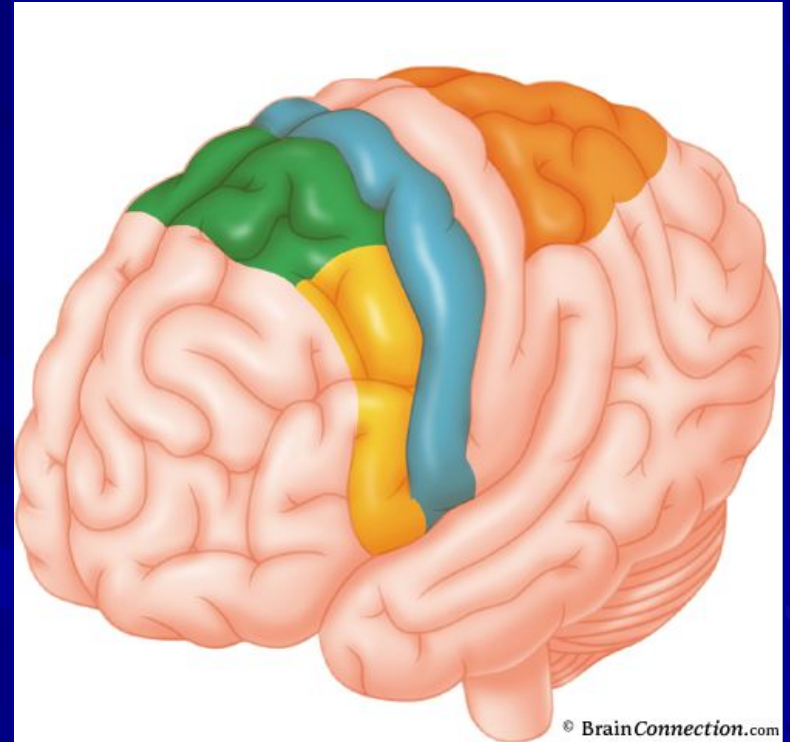
- Kinetic (sequential) organization of movements in writing
- Easiness of switching from one element of letter to another, from one letter to another.

## Brain area

Premotor cortex (Supplementary motor cortex - SMA)

## Brain mechanism

Kinetic mechanism



# Dysgraphia

## Component of the Functional System

### 4. Control of writing



# Dysgraphia

## Symptoms

- Lack of capitalization and punctuation
- Grammar mistakes

11 апреля  
Касторки и ясные денки. Жиди  
чат руки. Ужасная пунис-  
таф травка. Ужасные иду  
и влате в роизу. Ама Сав  
собева в рпм извета.  
Фреза, кукла, земмерика,  
козник, сирза, овес, дубки,  
русот, мак, симфа.

# Dysgraphia

## The role in writing

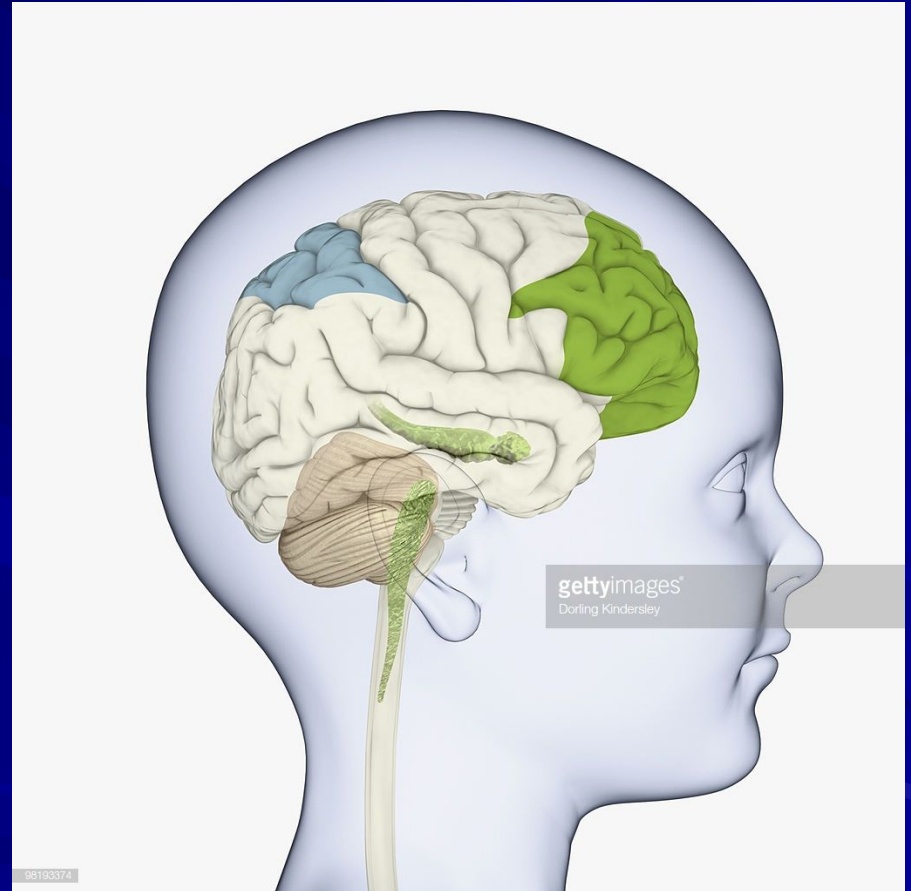
- Planning, initiation and control in writing
- Control in using punctuation and orthography rules.

## Brain area

Prefrontal cortex

## Brain mechanism

Executive abilities



# Dysgraphia

## Component of the Functional System

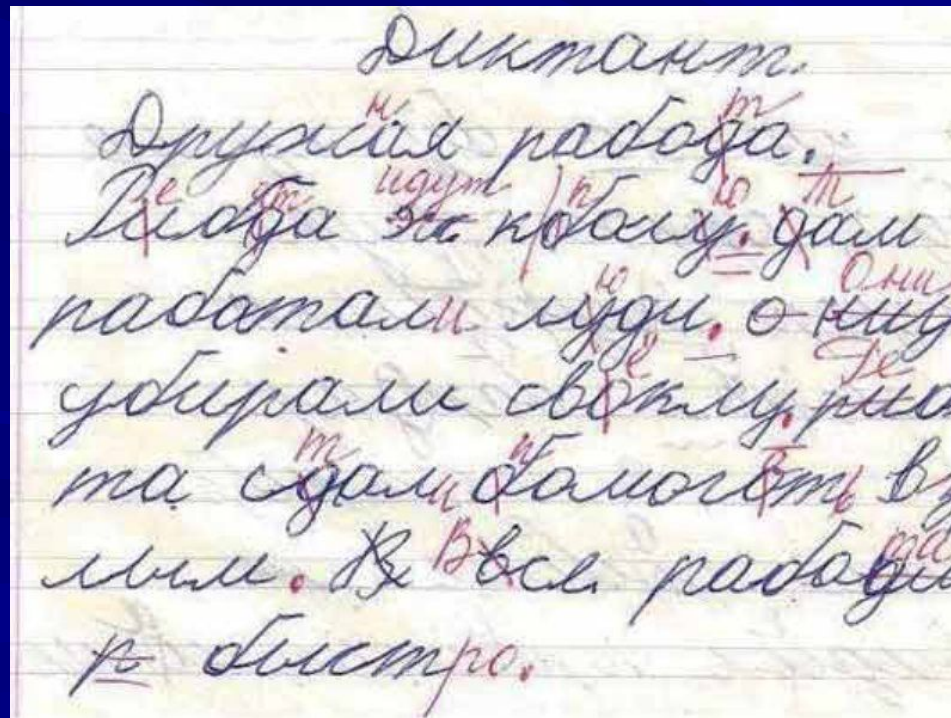
### 5. Phonemic perception



# Dysgraphia

## Symptoms and compensations

### Substitutions of opposite consonants (b/p)



# Dysgraphia

## Symptoms and compensations

*Compensation*  
use of a context

# Dysgraphia

## The role in writing

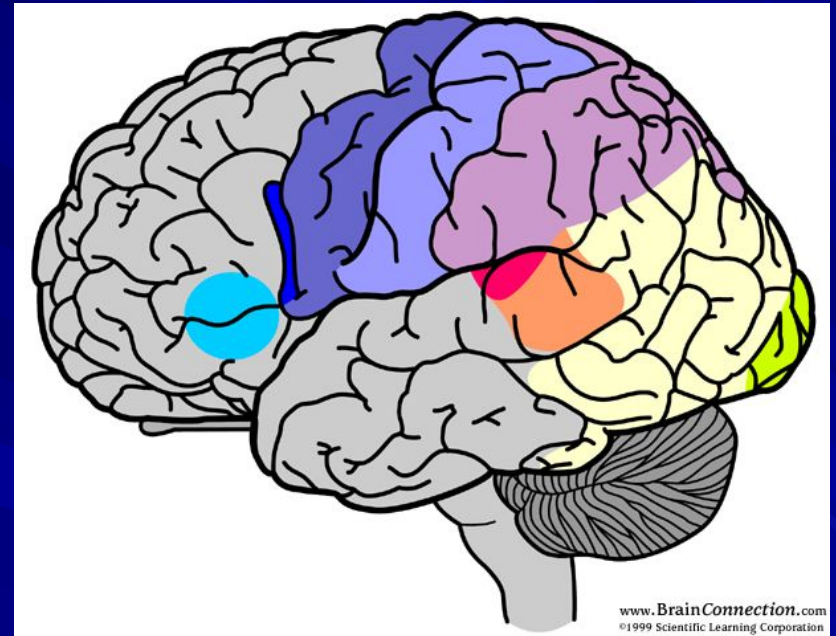
Differentiation of similar phonemes (opposite consonants, soft and hard consonants)

## Brain area

Primary auditory area of left temporal cortex

## Brain mechanism

Phonemic information  
Processing





# Dysgraphia

## Component of the Functional System

### 6. Working memory



# Dysgraphia

## Symptoms and compensations

- Omissions of words in sentences

- Changing position of words in a sentences

- *Compensation* – replacement words close in meaning

My friend Peter will come to me on Sunday.

My friend will come to me

# Dysgraphia

## The role in writing

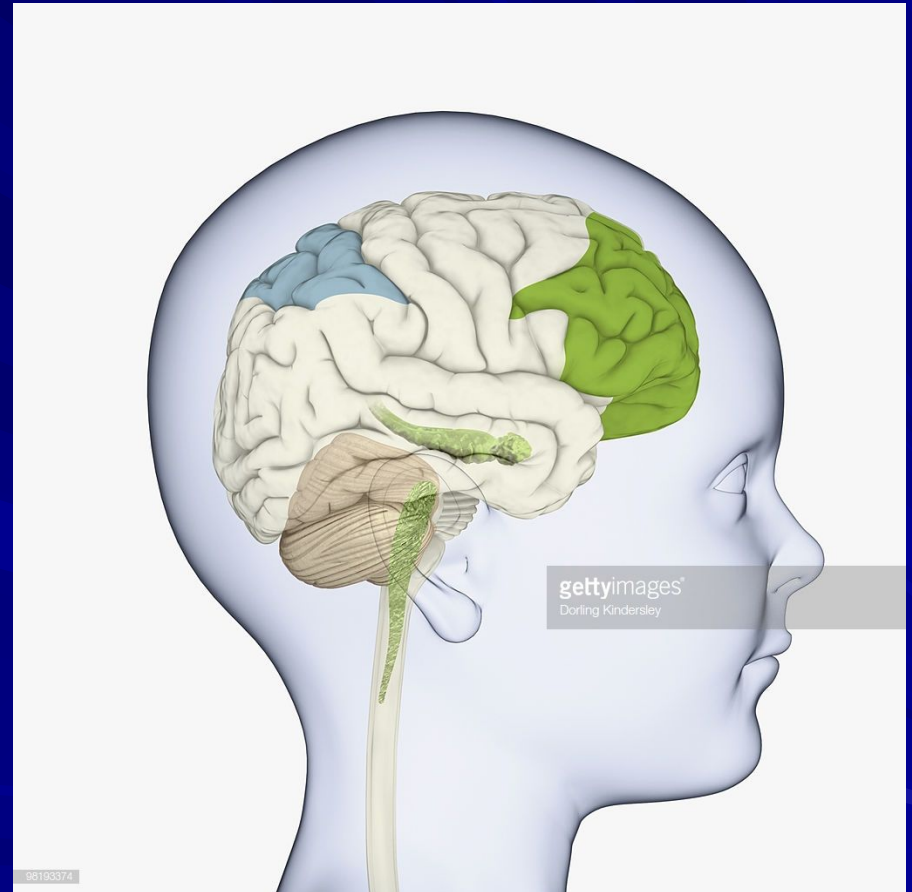
Retaining information for writing using working memory

## Brain area

Prefrontal cortex

## Brain mechanism

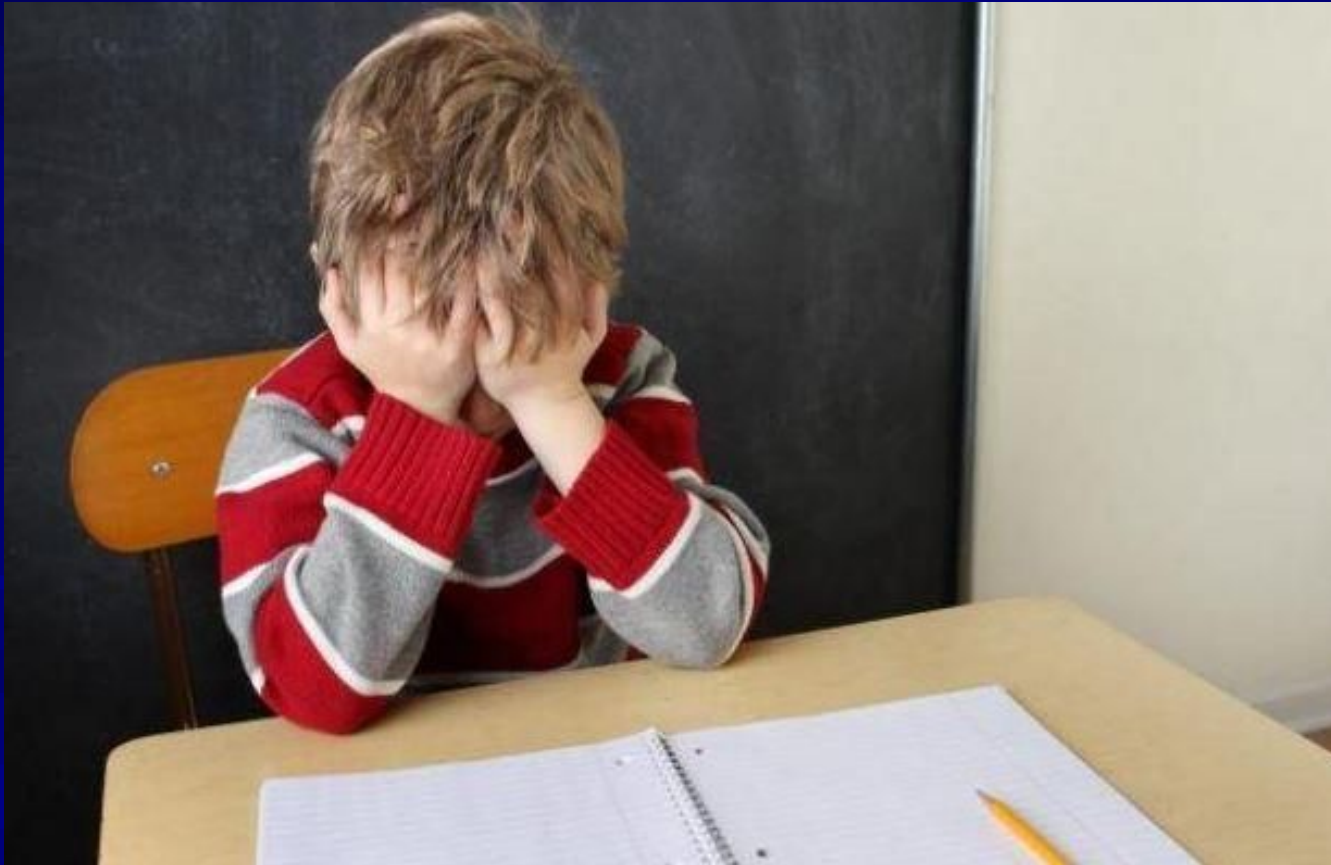
Working memory



# Dysgraphia

## Component of the Functional System

### 7. Stability in writing



# Dysgraphia

## Symptoms of disturbances and compensations

- Micrographia
- Fluctuations in pen pressure
- Intervals disproportion
- Slow writing
- Difficulties in retaining working posture
- Large fluctuations in the rate and success of writing during a lesson

# Dysgraphia

## The role in writing

- Maintaining the level of cortical activation during writing
- Stability of activation and attention concentration

## Brain area

First functional unit (unit of activation)

## Brain mechanism

Neurodynamic mechanism

