



# Apraxia

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# Learning Objectives

- ▶ **Definitions.**
- ▶ **Historical perspective**
- ▶ **Model/Anatomy**
- ▶ **Classification of limb Apraxias**
- ▶ **Testing of the limb Apraxias**





▶ **Praxis** means the ability to perform voluntary skilled movements.


Deftness or agility

spatial trajectory

Conceptual knowledge of objects and tools.

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- ▶ **Apraxia** is defined as an inability to correctly perform skilled movements with the arms and hands in the absence of primary sensory or motor impairments that could account for this disability.
  - ▶ A first step in recognizing the limb apraxias is distinguishing them from other causes of impaired movement.
  - ▶ motor deficits such as weakness, hemiparesis, spasticity, ataxia, or extrapyramidal disturbances.

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- ▶ primary sensory deficits, hemispatial neglect, spatial or object agnosia, or other sensory or spatial disorders.
  - ▶ Abnormal movements or postures such as tremor, myoclonus, choreoathetosis, or dystonic posturing.
  - ▶ Finally, it is not apraxia if the impaired movements result from other cognitive disorders involving attention, memory, language comprehension,

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- ▶ Limb apraxia occurs in about 50%–80% of patients with left hemisphere lesions and can persist as a chronic deficit in 40%–50% of these.
  - ▶ stroke (Donkervoort et al., 2000),
  - ▶ multiple sclerosis (Kamm et al., 2012, Rapaić et al., 2014),
  - ▶ tumors such as parietal gliomas (Liouta et al., 2018),
  - ▶ corticobasal syndrome (Armstrong et al., 2013),
  - ▶ Alzheimer disease (Stamenova et al., 2014), some forms of primary progressive aphasia (Adeli et al., 2013),

# HISTORICAL PERSPECTIVE

- ▶ In 1866, John Hughlings Jackson probably recognized limb apraxia when he observed that the patient had “power in his muscles and intact coordination”, but still couldn’t perform the movements.
- ▶ In 1870, Carl Maria Finkelnburg used “asymbolia” to describe the clumsy and incomprehensible communicative gestures in patients.
- ▶ In the early 1900s, Liepmann published a series of papers that led to the contemporary concept of limb apraxias.



Execution of purposeful movements could be divided into three steps.

- ▶ Retrieval of the spatial and temporal representation or “movement formulas” of the intended action from the left hemisphere.
- ▶ Transfer and association of these movement formulas via cortical connections with the “innervatory patterns” or motor programs located in the left premotor and supplementary motor areas [SMAs]).
- ▶ Transmission of the information to the left primary motor cortex for performance of the intended actions in the right limb.





# CLASSIFICATION OF LIMB APRAXIAS

(Heilman and Rothi, 2012)

- ▶ **Ideomotor Apraxia, Parietal Variant :**
- ▶ Most common and prototypical limb apraxia.
- ▶ Disruption of movement formulas in left inferior parietal lobule
- ▶ Failure to adopt the correct posture or orientation of the arm and hand or to move the limb correctly in space and at the correct speeds.

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- ▶ Difficulty in recognizing or identifying gestures.

# Ideomotor Apraxia, Disconnection Variant

- ▶ Disruptions of motor programs in the SMA or in their intra- and interhemispheric connections.
- ▶ impaired pantomime to verbal commands, impaired imitation of gestures, and the presence of spatiotemporal production errors.
- ▶ In contrast to the parietal variant of ideomotor apraxia, these patients can recognize and identify gestures.

# Dissociation Apraxia

- ▶ Impaired movement when attempting to perform skilled movements in response to verbal commands, but they are able to imitate gestures and to indicate or use actual objects correctly.
- ▶ No recognizable movement .
- ▶ specific disconnection between language areas and movement formulas in the inferior parietal lobule.

# Ideational Apraxia

- ▶ Ideational apraxia is the inability to correctly order or sequence a series of movements to achieve a goal.
- ▶ such as preparing, addressing, and then mailing a letter.
- ▶ Lesions in the left hemisphere that involve the frontal lobe and SMA.

# Conceptual Apraxia

- ▶ Conceptual apraxia results in errors in action semantics, specifically involving the content of the action, such as in tool-selection errors or in tool-object knowledge.
- ▶ For example, when asked to demonstrate the use of a hammer or a saw either by pantomiming or using the tool, the patient may pantomime a screwing twisting movement as if using a screwdriver.
- ▶ Most common in Alzheimer disease

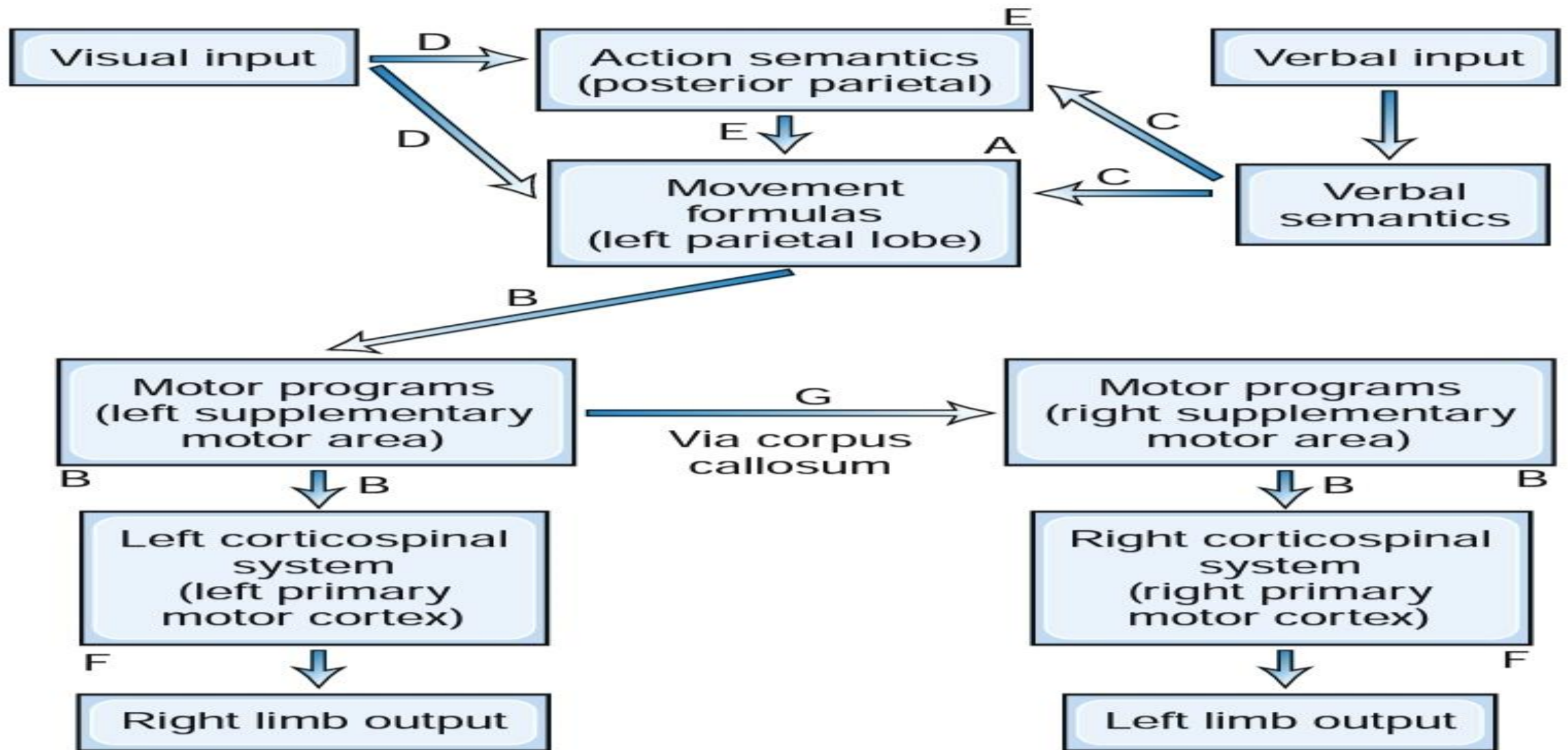
# Limb-Kinetic Apraxia

- ▶ Loss of dexterity or deftness that makes fine motor movements such as buttoning or tying shoes difficult.
- ▶ Limb-kinetic apraxia results from lesions in the left SMA, the primary motor cortex, or even in the corticospinal system



# Callosal Apraxia

- ▶ The apraxia is confined to the nondominant limb, usually the left arm or hand in right-handed individuals.
- ▶ Several limb apraxia syndromes can result from callosal lesions .
- ▶ patients can have a callosal “alien limb” with independent movements of the nondominant limb,
- ▶ classic example of this is the split-brain patient who has undergone a corpus callosotomy and finds that his or her left hand is unbuttoning his shirt while the right one is trying to button it.



**Fig. 11.2 Lesions in Limb Apraxias.** Praxis disturbances can result from various brain localizations as illustrated here. **A**, Ideomotor apraxia, parietal variant. **B**, Ideomotor apraxia, disconnection variant. **C**, Verbal dissociation apraxia. **D**, Visual dissociation apraxia. **E**, Conceptual apraxia. **F**, Limb-kinetic apraxia. **G**, Callosal apraxia.

# Testing of limb apraxias



- ▶ Exclude the presence of significant
- ▶ motor,
- ▶ sensory, or
- ▶ cognitive disorders that could explain the inability to perform learned skilled movements.

# DOMINANT UPPER EXTREMITY

## ▶ 1. PANTOMIME TO VERBAL COMMAND

### a. Transitive actions:


Comb hair

Brush teeth

Flip a coin

Use scissors

### b. Intransitive actions:

- 
- ▶ Wave goodbye
  - ▶ Beckon someone to come
  - ▶ Indicate someone to stop
  - ▶ Salute

## 2. IMITATION OF GESTURES

- ▶ The examiner demonstrates the same actions without naming them and asks the patient to copy them.

## 3. GESTURE KNOWLEDGE

The examiner demonstrates different actions and asks the patient to identify their function/purpose and how well they were performed

# 4. SEQUENTIAL ACTIONS

- ▶ The examiner asks the patient to show
  - . how to prepare a letter for mailing,
  - . sandwich for eating,
  - . A bowl of cereal with milk.
  
- ▶ The examiner instructs the patient that the imaginary elements needed for the task are laid out in front of them



# 5. CONCEPTUAL KNOWLEDGE

- ▶ The examiner shows the patient either pictures or the actual tools or objects and asks the patient to pantomime or demonstrate their use or function.
- ▶ The examiner may also show a task, such as holding a nail, and ask the patient to pantomime the correct tool use and action.

# 6. LIMB-KINETIC MOVEMENTS

- ▶ Finger tapping
- ▶ Alternate touching each fingertip with thumb
- ▶ Pick up a coin without sliding
- ▶ Twirl coin between thumb, index, and middle fingers

# 7. REAL OBJECT USE

- ▶ If limb apraxia is present, test with real object use.
- ▶ Most limb apraxias improve when using real objects for transitive actions and when gesturing spontaneously with intransitive actions.

## II. NONDOMINANT UPPER EXTREMITY



- ▶ Repeat the same procedures as for the dominant upper extremity

**TABLE 11.1 Testing in Limb Apraxias**

	<b>Ideomotor, parietal</b>	<b>Ideomotor, disconnection*</b>	<b>Dissociation*</b>
Pantomime to verbal command	<b>Abnormal</b> <sup>†</sup>	<b>Abnormal</b> <sup>†</sup>	<b>Abnormal</b> <sup>‡</sup>
Imitation of gestures	<b>Abnormal</b> <sup>†</sup>	<b>Abnormal</b> <sup>†</sup>	Normal
Gesture knowledge	<b>Abnormal</b>	Normal	Normal
Sequential actions	Normal <sup>†</sup>	Normal	<b>Abnormal</b>
Conceptual knowl- edge of tool use	Normal	Normal	Normal
Limb-kinetic movement	Normal	Normal	Normal
Real object use	Normal/ <b>abnormal</b> <sup>#</sup>	Normal/ <b>abnormal</b> <sup>#</sup>	Normal

	Ideational*	Conceptual*	Limb-kinetic
Pantomime to verbal command	Normal <sup>§</sup>	<b>Abnormal</b> <sup>  </sup>	Normal
Imitation of gestures	Normal <sup>§</sup>	Normal	Normal <sup>  </sup>
Gesture knowledge	Normal	Normal	Normal
Sequential actions	<b>Abnormal</b>	<b>Abnormal</b>	Normal
Conceptual knowledge of tool use	<b>Abnormal/normal</b> <sup>§</sup>	<b>Abnormal</b>	Normal
Limb-kinetic movement	Normal	Normal	<b>Abnormal</b>
Real object use	Normal/ <b>abnormal</b> <sup>#</sup>	<b>Abnormal</b> <sup>  </sup>	Normal/ <b>abnormal</b> <sup>#</sup>

THANK YOU