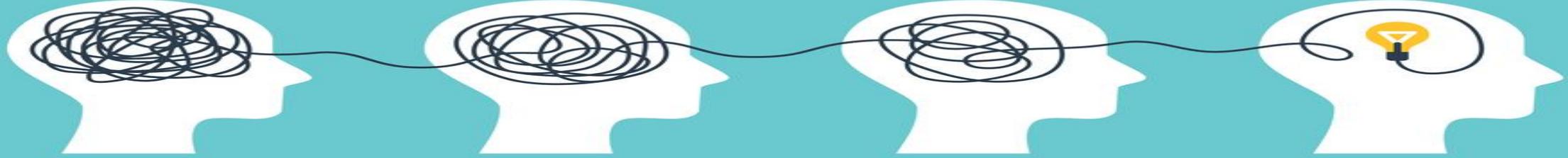


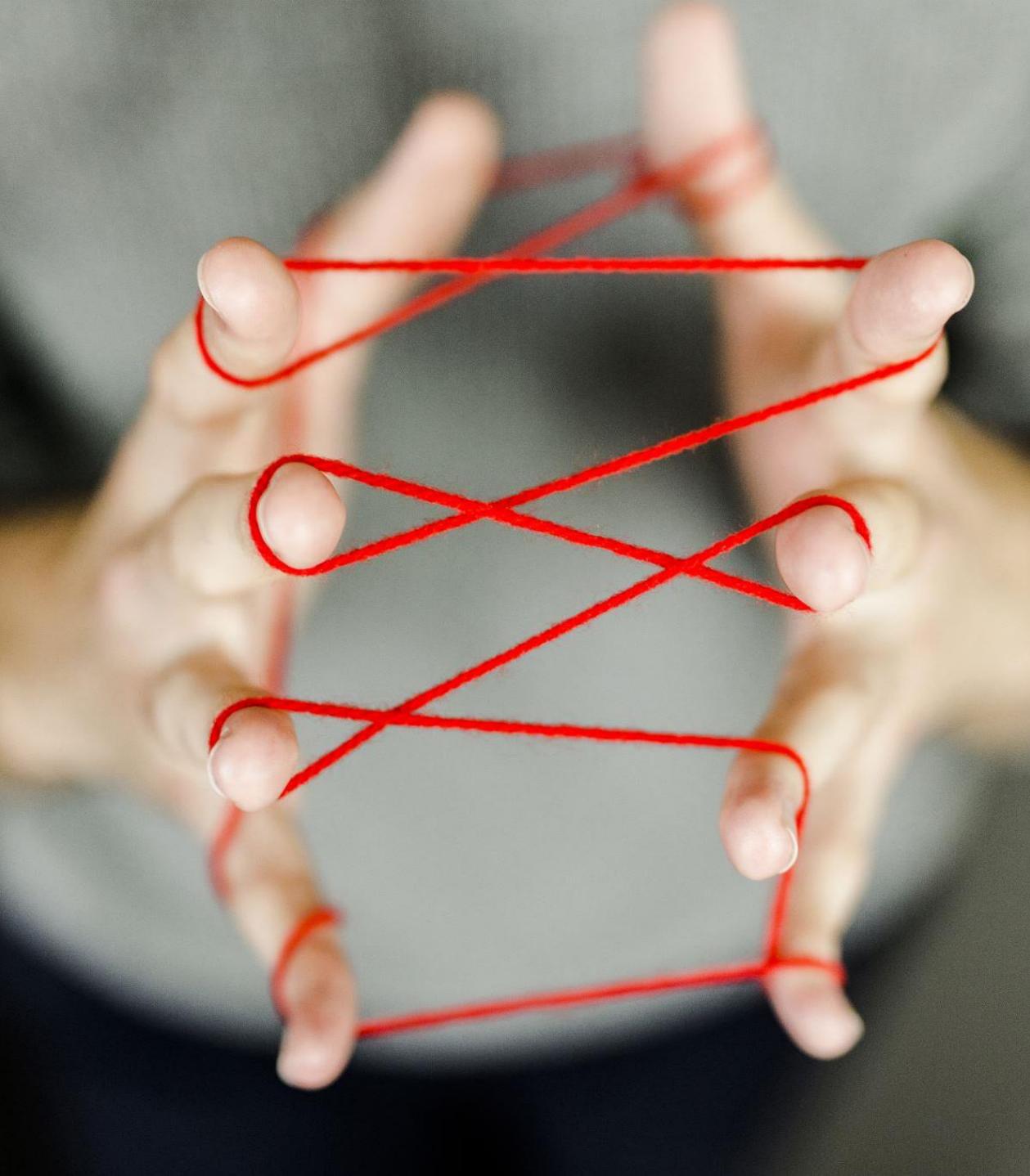
**Practice
effects, motor
skill, transfer
of training, and
habits**





Skill
-An ability that
can be
improved over
time through
practice.

- **Perceptual-motor skill :** Skills that involve **physical movement** and are controlled by sensory inputs (e.g., hand-eye coordination, balance, etc). These skills rely on physical dexterity.
- **Cognitive skill:** Skill that requires thinking, reasoning, problem solving or the application of strategies (mental dexterity)



- **Closed Skill**- A skill performed in a **predictable, stable environment** where the **movements remain constant**. It involves perfecting a specific movement sequence.

Examples:

- Typing
- Handloom weaving
- Tabla player

- **Open Skill**: A skill performed in a **dynamic, unpredictable environment** where **movements have to adapt based on external factors**. Open skills require a combination of perceptual-motor and cognitive skills.

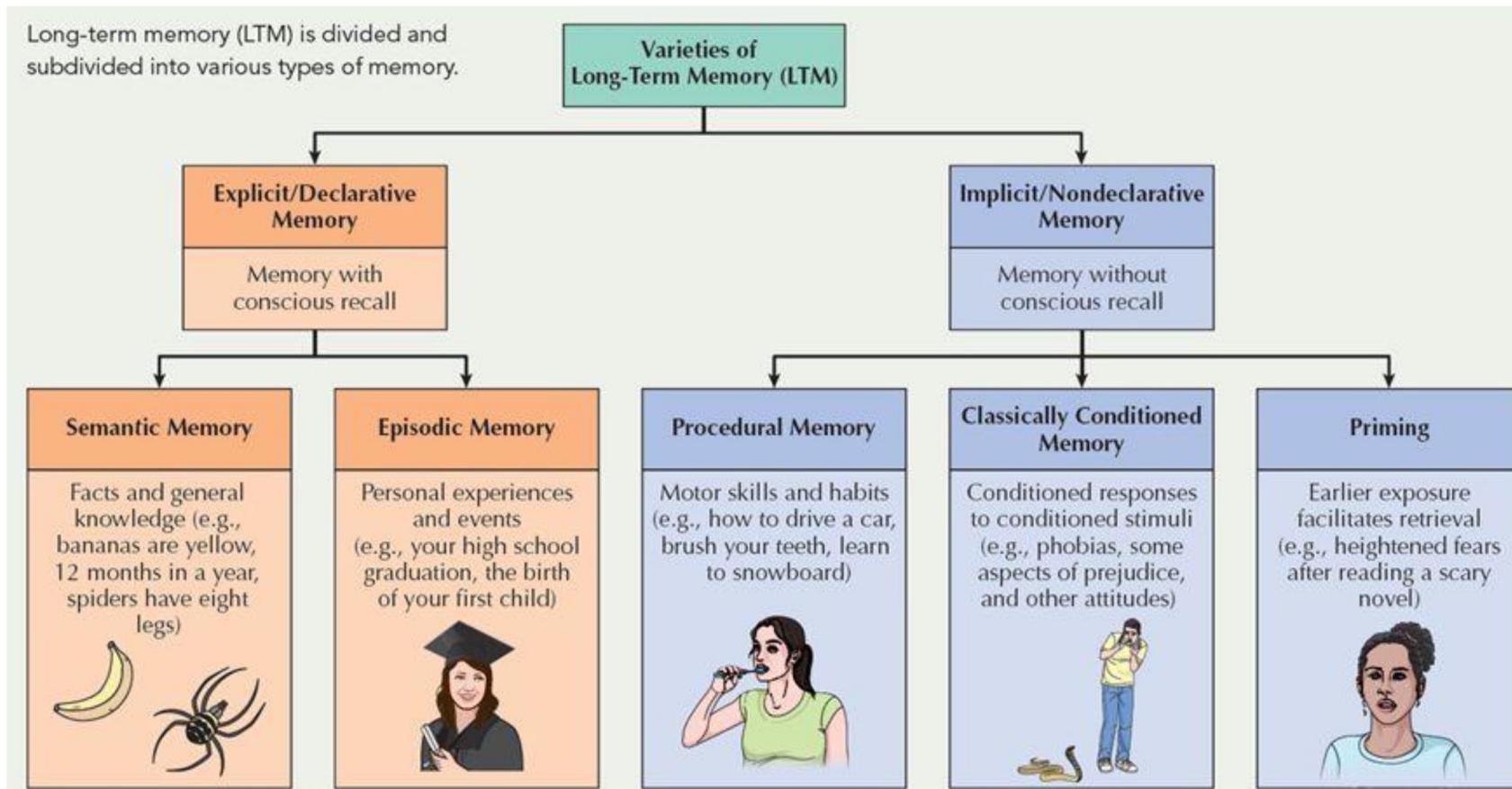
Examples :

- Driving
- Dancing
- All-terrain cycling marathon

Categorize the skill

- Playing football
- Solving a crossword puzzle
- Shooting a basketball free throw
- Swimming in a pool race
- Driving in heavy traffic
- Painting a portrait
- Juggling
- Playing video games
- Running on a treadmill
- Debating in a competition

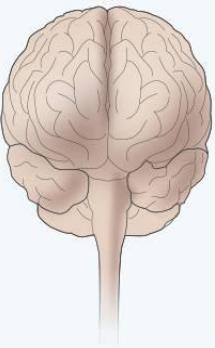
Types of Long-Term Memories





How Do We Learn a Motor Skill?

Fitts and Posner's Model of Motor Learning



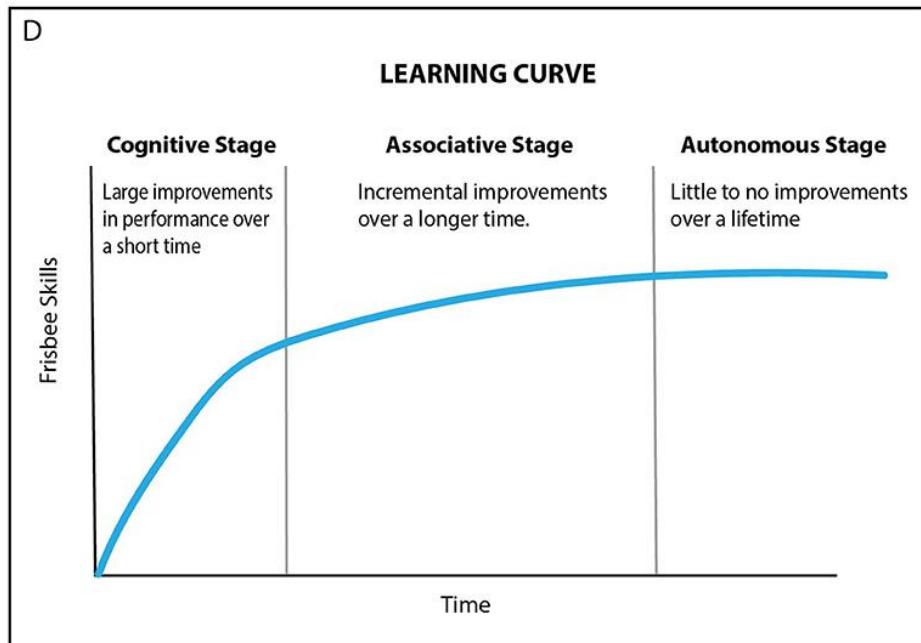
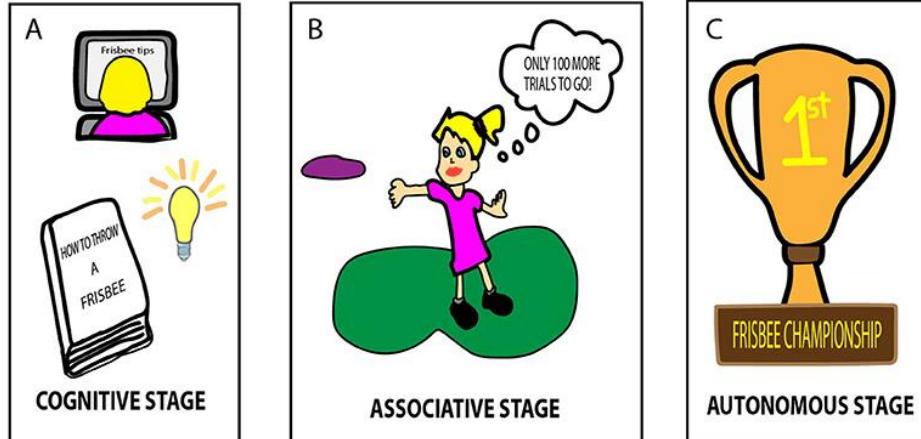
Cognitive Stage
Learners expend cognitive energy to understand how they are supposed to move

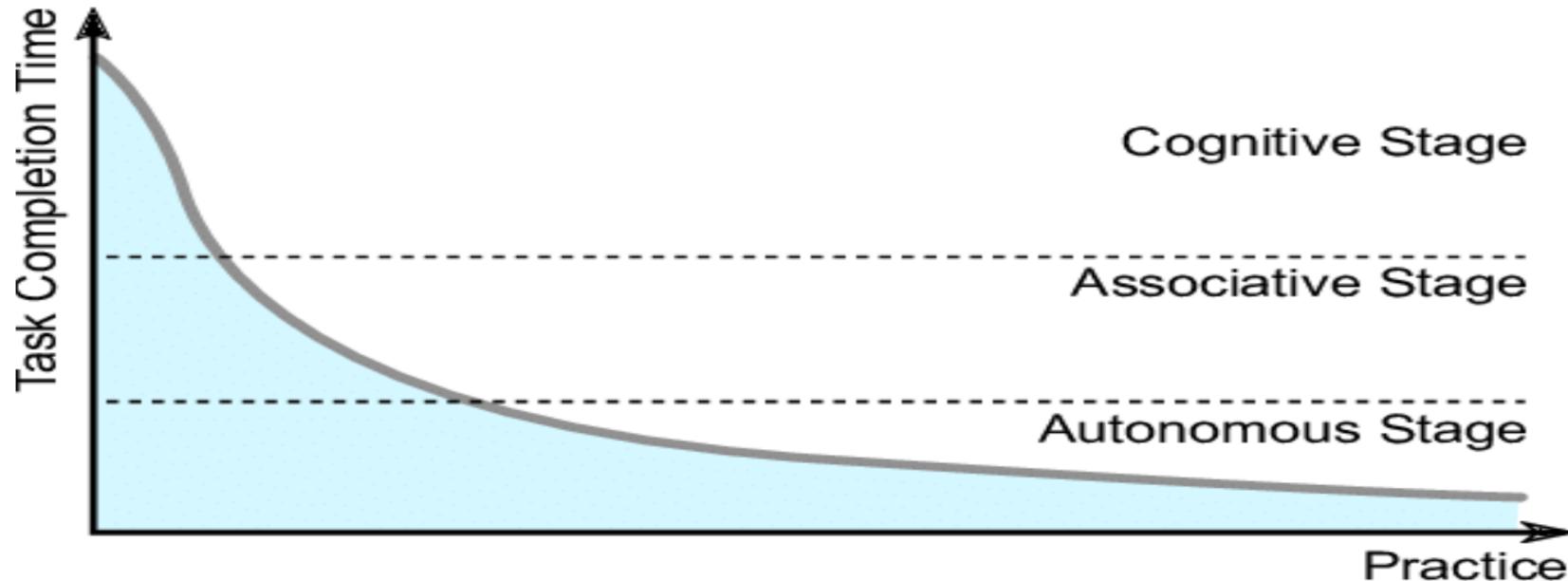
Associative Stage
Learners have mastered the basic forms of movement and begin to refine their skills with practice



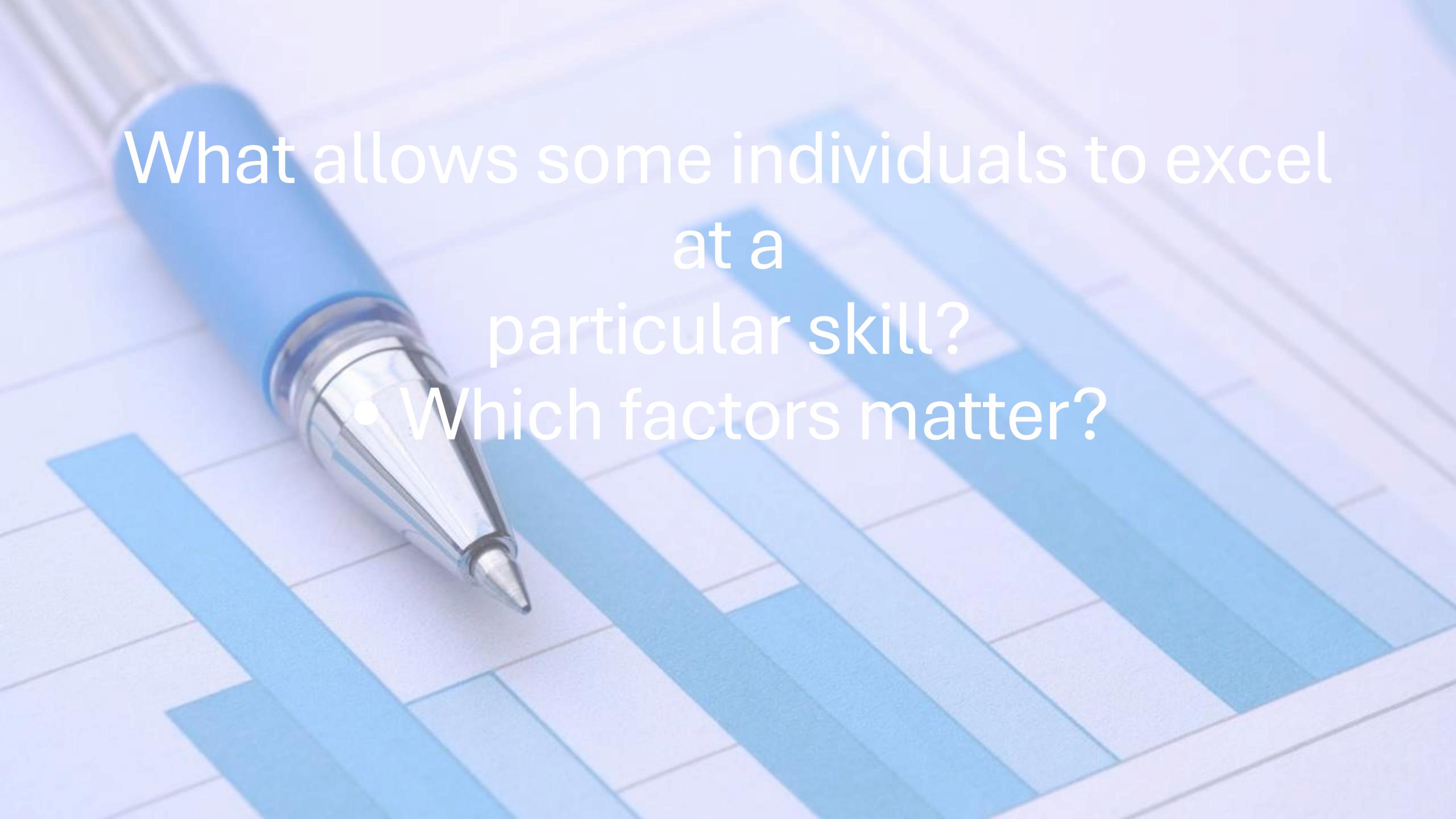
Autonomous Stage
Learners perform movements automatically without cognitive energy, and can focus on strategy

Adapted from *Life Span Motor Development, Seventh Edition*,
by Kathleen M. Haywood and Nancy Getchell
© Human Kinetics





| Stage | Characteristics | Example |
|----------------------|---|---|
| 1. Cognitive stage | Performance is based on rules that can be verbalized. | Using written instructions to set up a tent |
| 2. Associative stage | Actions become stereotyped. | Setting up a tent in a fixed sequence, without instructions |
| 3. Autonomous stage | Movements seem automatic. | Setting up a tent while carrying on a discussion about politics |

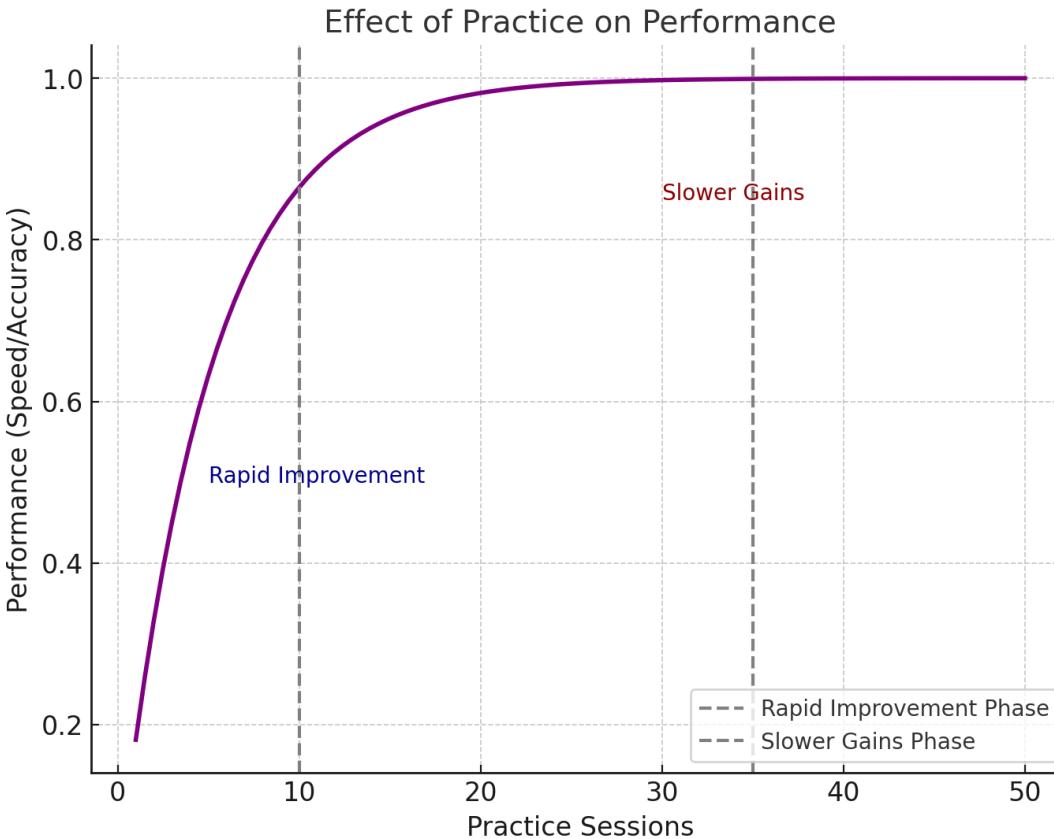
A blue pen with a silver clip and a clear barrel lies diagonally across a white page with light blue horizontal lines. The pen's cap is off and placed next to it. The background is a soft-focus version of the same scene.

What allows some individuals to excel
at a
particular skill?

- Which factors matter?

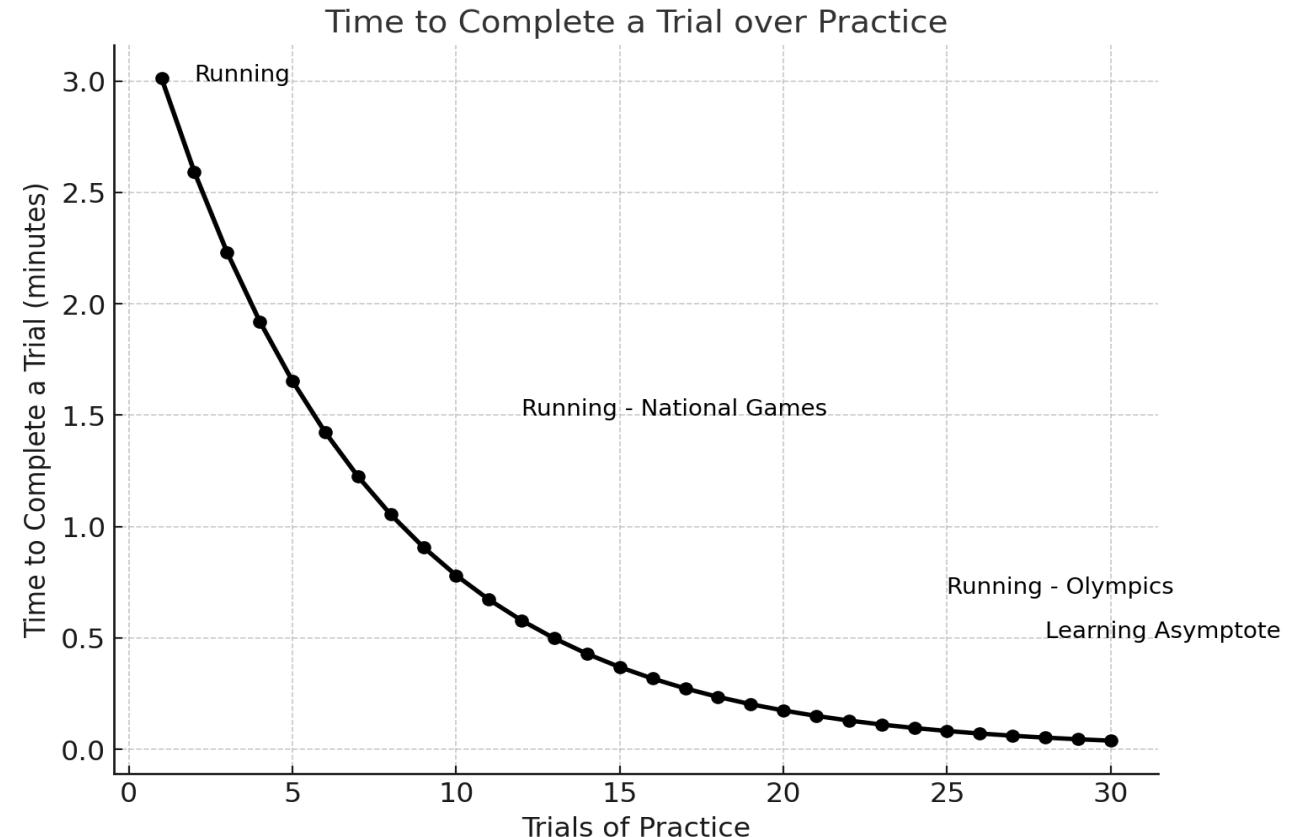
Practice Effects

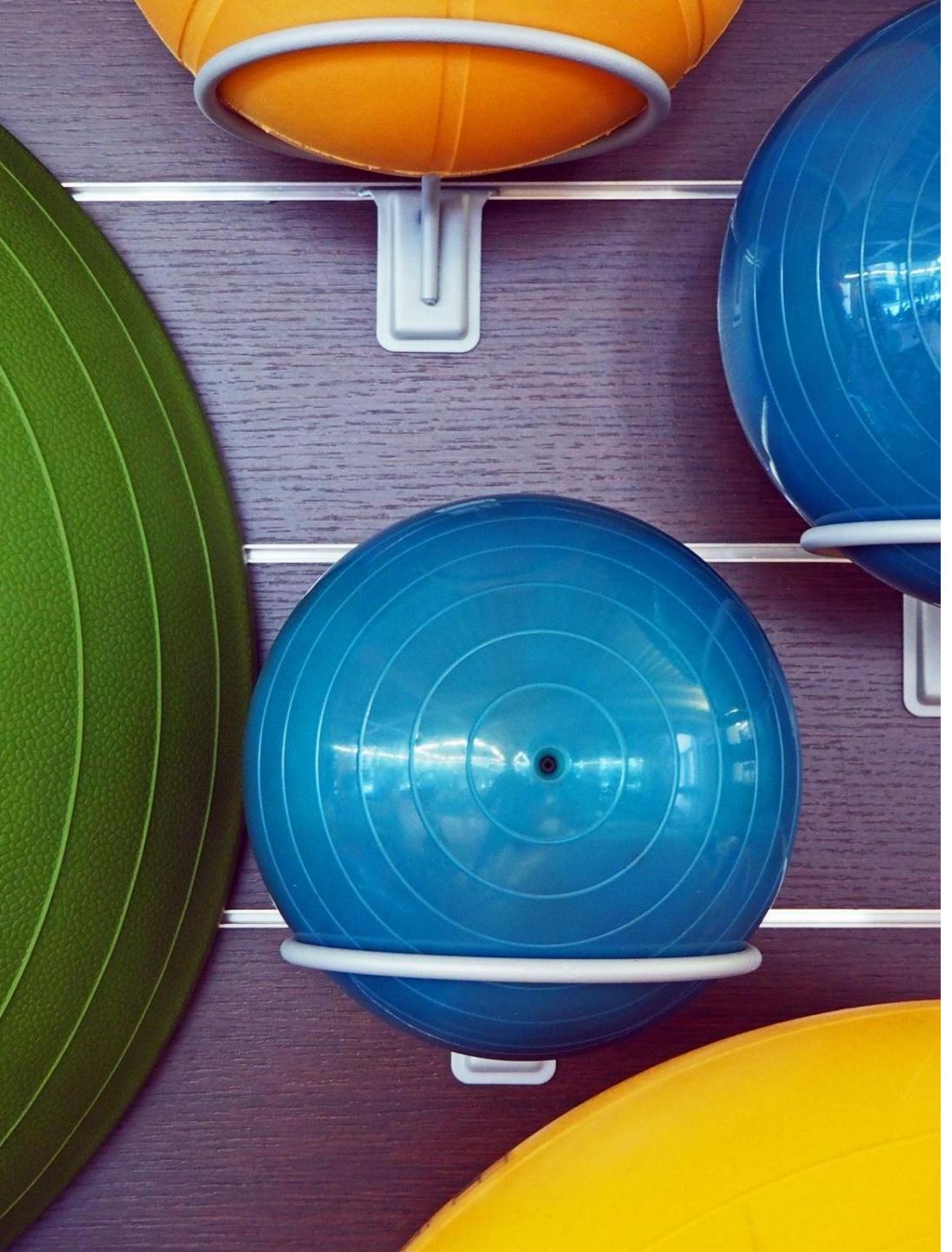
- refer to the improvement in performance that results from repeated practice or exposure to a task. The more you practice a skill, the better and faster you become at it.



The **Power Law of Practice** states that the rate of performance improvement is initially rapid but slows down as practice continues.

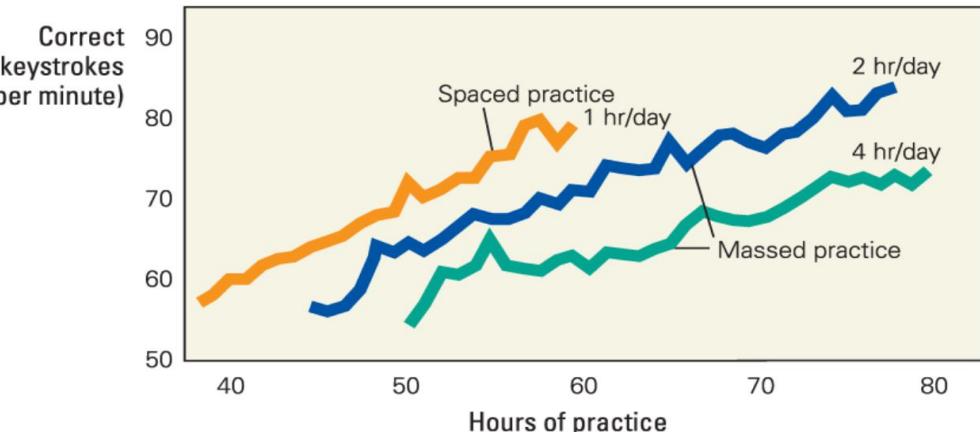
- **Early Learning:** During the early stages, gains are large and noticeable.
- **Later Stages:** Over time, improvements become smaller as you approach the limits of your ability.





Timing and Sequencing of Practice

- **Massed Practice:** Practicing a skill intensively over a short period, without rest or breaks. For example, cramming for an exam or practicing a sport for several hours in one go.
- **Distributed Practice:** Spacing out practice over time, with breaks in between. For example, practicing for 30 minutes every day instead of 4 hours in one session.



Gluck et al., *Learning and Memory*, 4e, © 2020 Worth Publishers

The performance of post office workers using a keyboard to control a letter-sorting machine improved at different rates, depending on their training schedules.

Feedback in Practice

- **Importance of Feedback:** Effective practice also relies on feedback, which helps learners identify mistakes and improve their technique. Feedback can be **intrinsic** (from your own awareness of how you're performing) or **extrinsic** (from a coach, teacher, or results).

Overlearning

: Overlearning is when you continue practicing a skill even after you've achieved proficiency. It helps reinforce the skill, making it even more automatic and resistant to forgetting.

Motor Skill vs. Cognitive Skill Practice

- **Differences in Practice:**
 - **Motor Skills:** Motor skill practice usually involves physical movements that need to be perfected through repetition (e.g., sports, playing an instrument).
 - **Cognitive Skills:** Cognitive skills (e.g., problem-solving, memorization) improve through mental practice and the ability to apply strategies. These also benefit from distributed practice and feedback.

Music Practice

HOW MUCH SHOULD YOU PRACTICE?

| | | | |
|--|------------------|-----------------|---|
| | 1 - 2 HRS/WEEK | 10 - 20 MIN/DAY | Not likely to stick with music over a long period of time. |
| | 3 - 4 HRS/WEEK | 20 - 40 MIN/DAY | A starting place for young or new musicians. However, after a proper warm up, not much time is left to accomplish anything. |
| | 7 HRS/WEEK | 1 HR/DAY | The minimum time that must be spent in order to see change in your abilities over time. |
| | 10 - 15 HRS/WEEK | 1.5 - 2 HRS/DAY | RECOMMENDED. A good amount of time to thoroughly warm up and make true accomplishments in each session. |
| | 20 - 30 HRS/WEEK | 3 - 4 HRS/DAY | For musicians who are serious about becoming virtuosic players or making a living with their craft. |
| | 30+ HRS/WEEK | 5+ HRS/DAY | For top-tier musicians looking to leave a legacy. Examples include Lang Lang and Franz Liszt. |



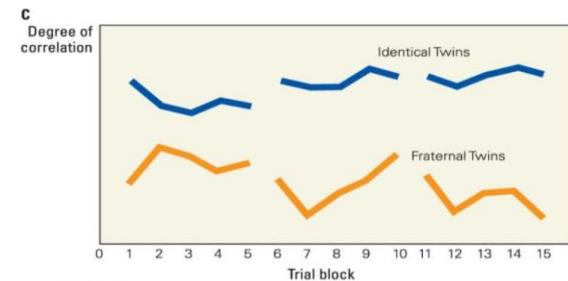
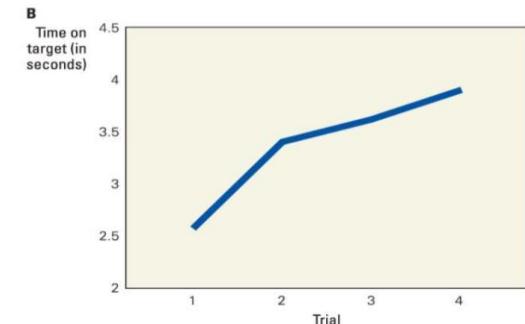
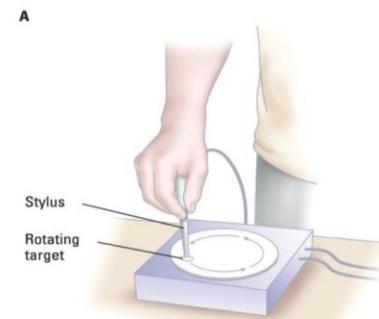
Sequencing of Practice: Why Variation is Important

- **Blocked Practice:** Practicing one skill or task repeatedly in a block before moving on to another.
 - **Example:** In sports, a tennis player might practice only forehands for an hour before moving on to backhands.
 - **Effectiveness:** This is effective for short-term improvement but can lead to poor retention in the long run.
- **Random/Varied Practice:** Alternating between different tasks or skills during practice (e.g., mixing forehands and backhands during tennis practice).
 - **Example:** A tennis player alternating between forehands, backhands, and serves in random order during practice.
 - **Effectiveness:** Research shows that **random practice** leads to better long-term retention and skill transfer because the learner must constantly adapt to new tasks.

Talent?

- Child prodigies also need training – but they learn faster
- Do genes play a role?

Twin studies



Gluck et al., *Learning and Memory*, 4e, © 2020 Worth Publishers

Practice can overcome the effects of talent – requires additional hours of training

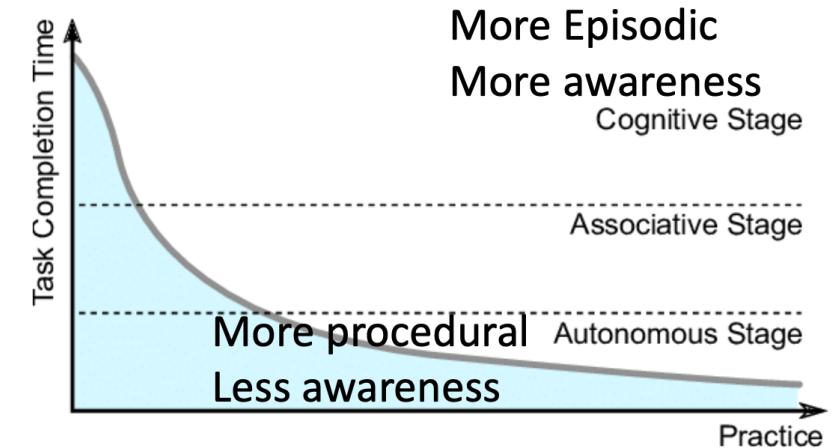


Fast-twitch muscle fibers are used to generate huge amounts of force but they cannot be active for too long. Good for short distance sprinting. Usain has more of these.

<https://qz.com/1043997/usain-bolt-is-the-fastest-human-in-the-world-heres-the-science-that-shows-how-he-does-it/>

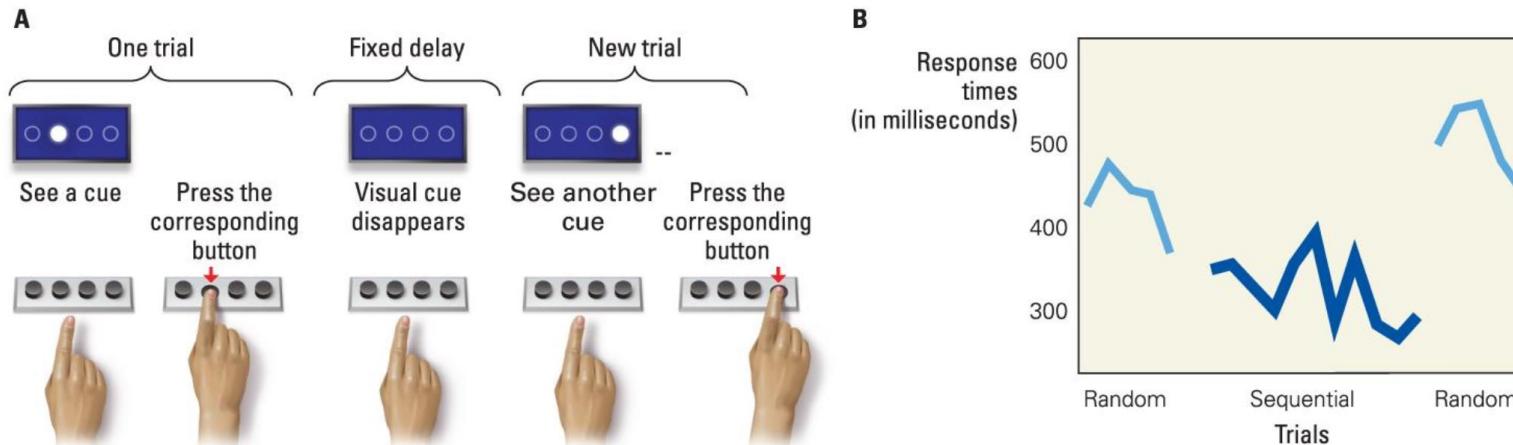
Skill memories are often formed unconsciously

- HM's mirror-tracing ability
- Process of learning is often unconscious – procedural (difficult to verbalize)
- Learning event may be remembered – episodic
- Difficult to study or prove the unconscious nature of learning – we study indirectly – ideas?



Serial Reaction Time Task

ABADBCDABCDCABADBCDABCDCABADBCDABCDCABADBCDABCDC



Gluck et al., *Learning and Memory*, 4e, © 2020 Worth Publishers

Implicit learning → faster reaction time

The background features several abstract, hand-drawn style shapes. At the top left is a large purple circle. To its right is a green triangle pointing downwards. In the center-left area, there is a large dark blue circle with a white center and a small white dot at the bottom left. Below it is a dark blue curved line resembling a stylized 'C'. To the right of the dark blue circle is a dark blue arrow pointing upwards and to the right. Further down and to the right is a pink oval. In the bottom right corner, there is a large orange circle with a blue outline and a blue dash above it. A green square is located in the bottom left corner.

Now that you've
learnt...



Transfer of training

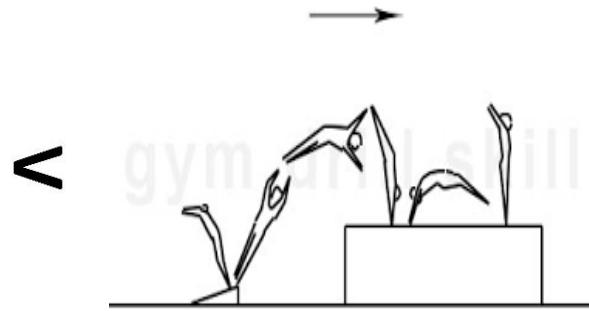
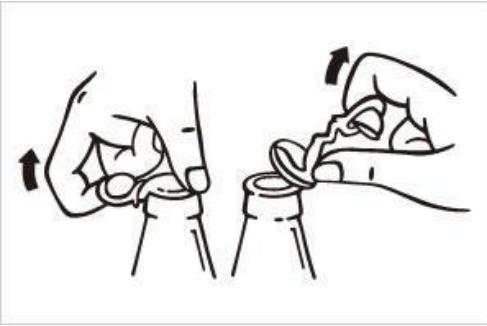
Extent to which one can apply a skill learned in one context in a novel situation

What about skills like playing badminton vs tennis?

There are some learned skills that have restricted applicability to only specific situations. This phenomenon is known as **transfer specificity**.

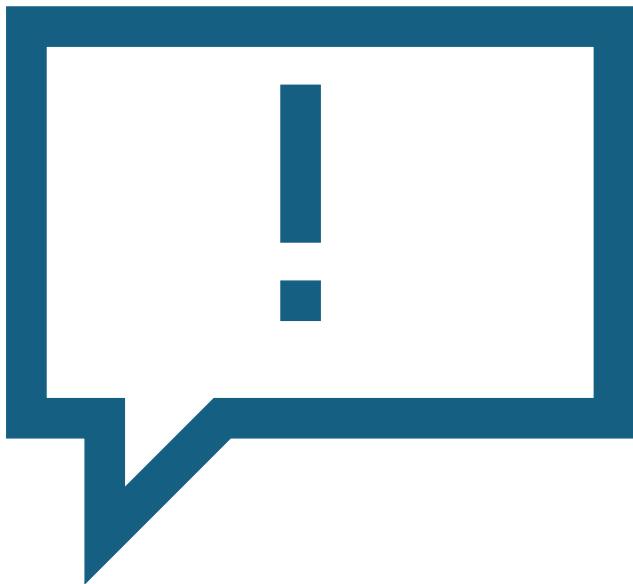
This depends on the number of elements in the new situation that are identical to those in the situation in which the skills were encoded.

Once acquired, the persistence of a skill depends on:



- Complexity of the skill
- How well the skill memory was encoded in the first place
- How often the skill has subsequently been performed [non-use causes skill- decay]
- Passage of time
- Interference from new skills (new dance sequence interferes with an old one)
- Learning interval between similar skills



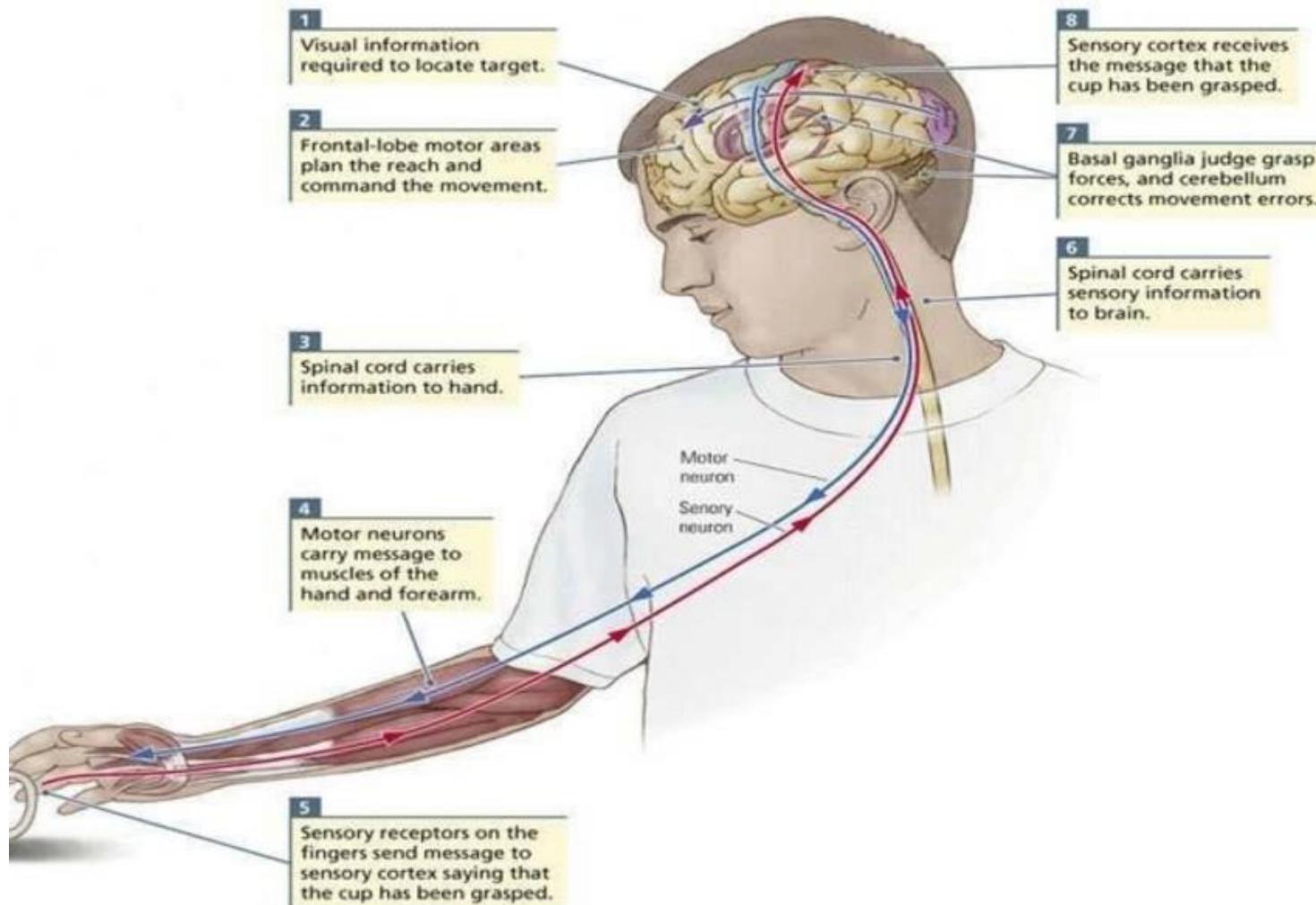


- Retention of perceptual-motor skills is better than retention of cognitive skills, that means they last longer, decay slower
- The forgetting curves are similar to learning curves - forgetting occurs quickly at first and then gets slower

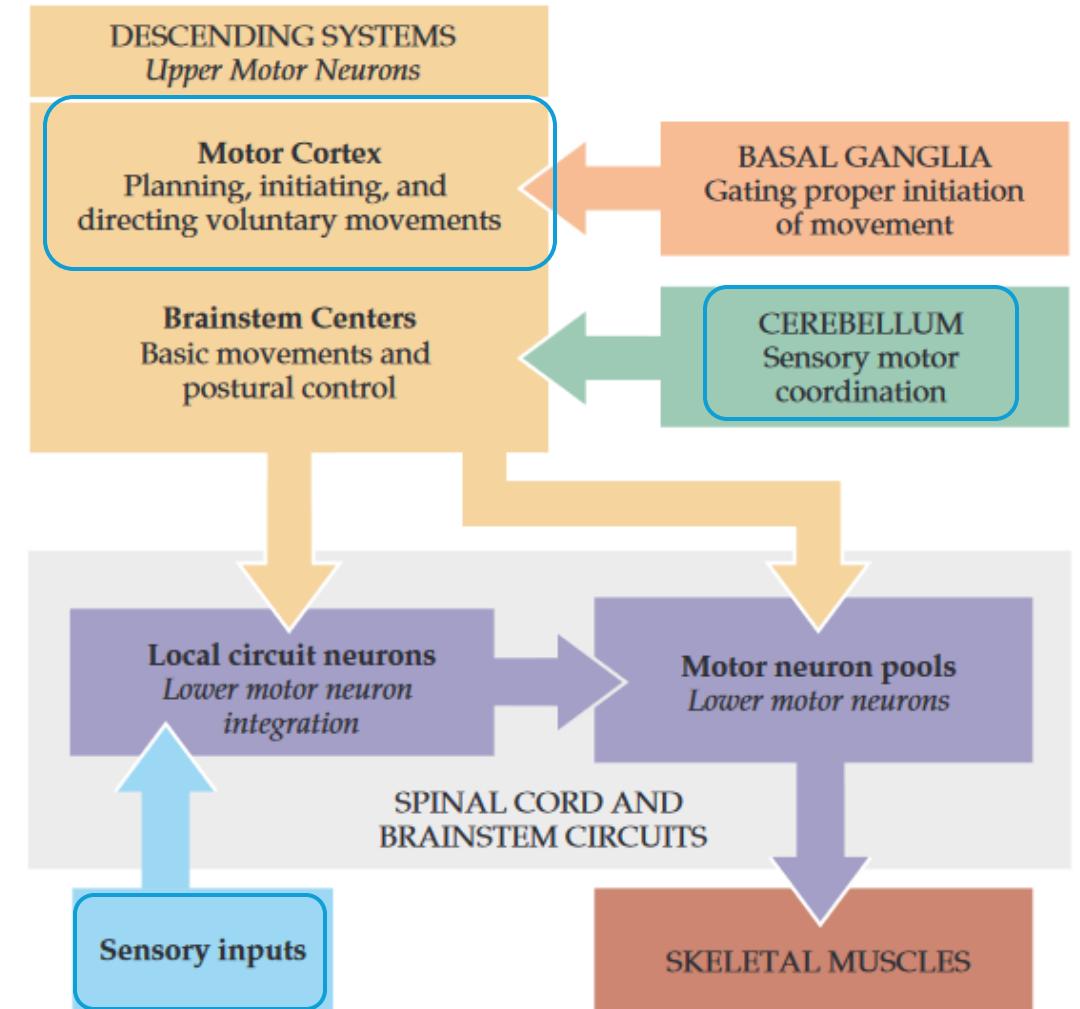
Habits vs Skills

- Universally, habits are stimulus–response (S–R) associations that become obligatory through repetition.
- Overtime, a skill becomes a set of habits- a phenomenon of automaticity. But we trade off flexibility with the speed of action.
- Deliberate practice, a key principle in the acquisition of expert performance, can be viewed as the process of iteratively improving a skill by temporarily breaking and then replacing habits with improved versions.

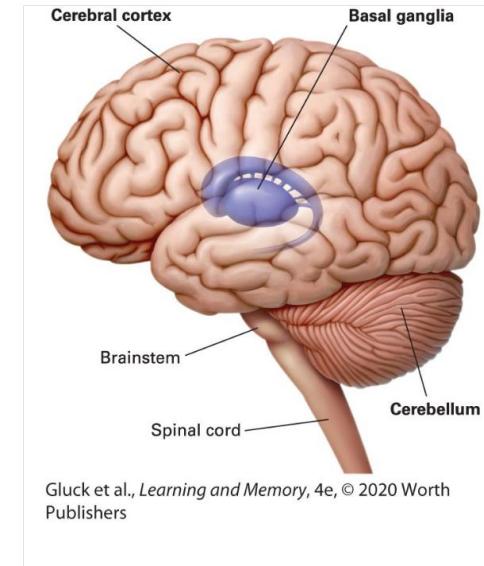
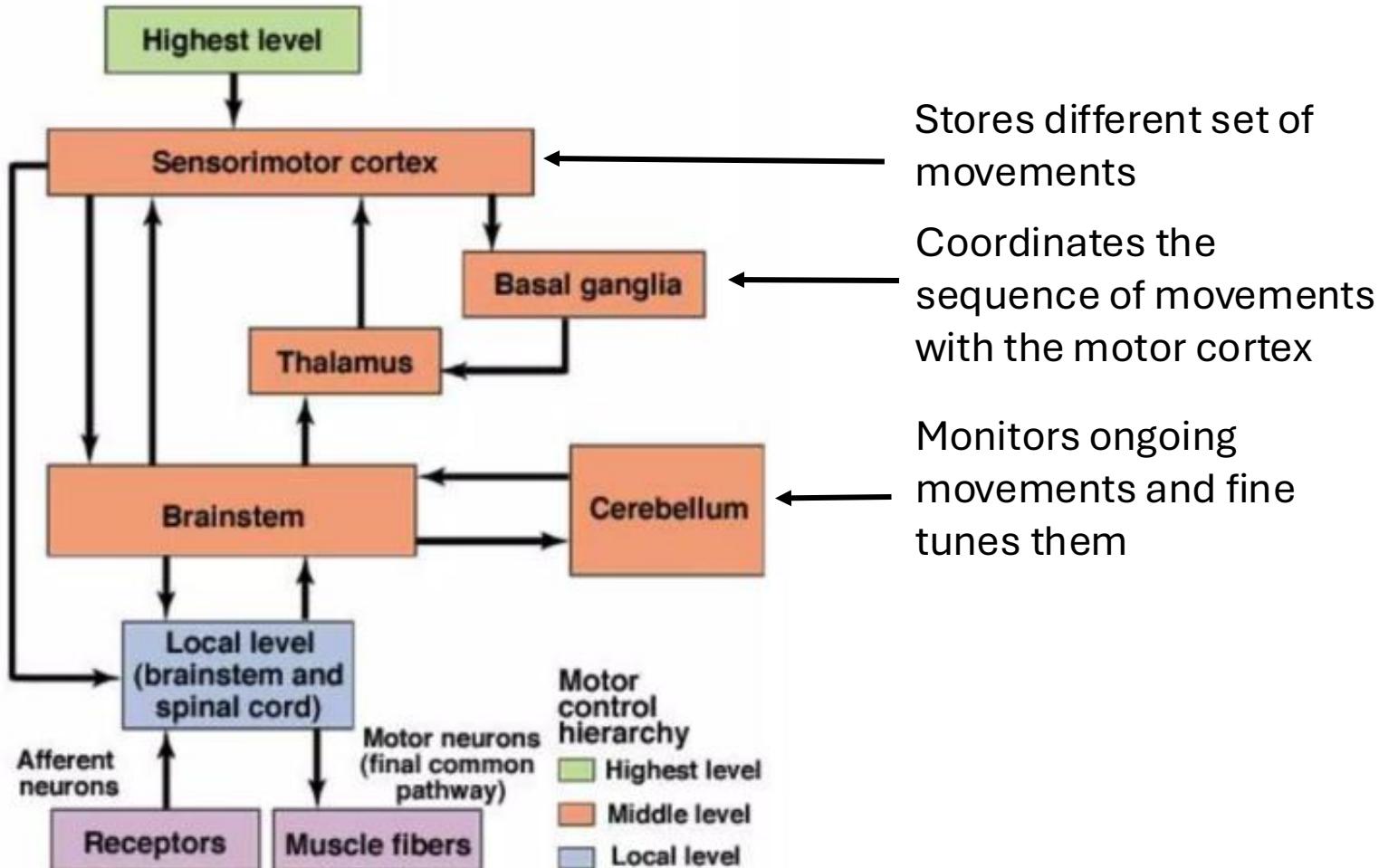
How do we perform an action?



Brain regions involved

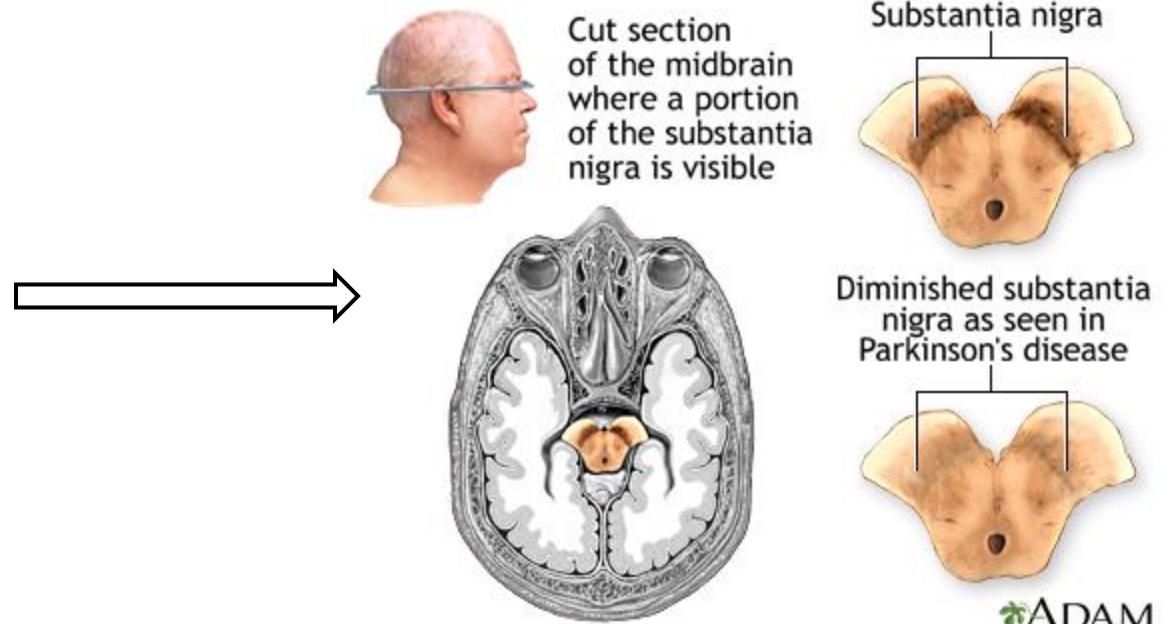
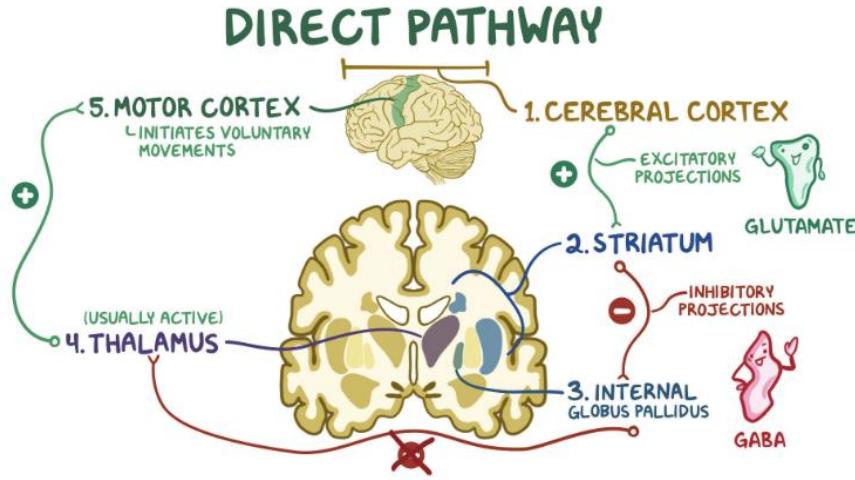


Brain regions that contribute to skill learning

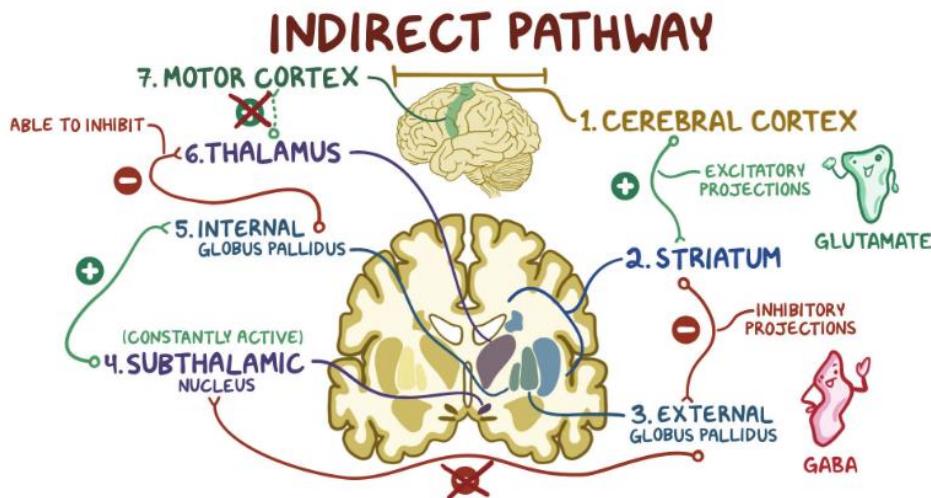


Basal ganglia

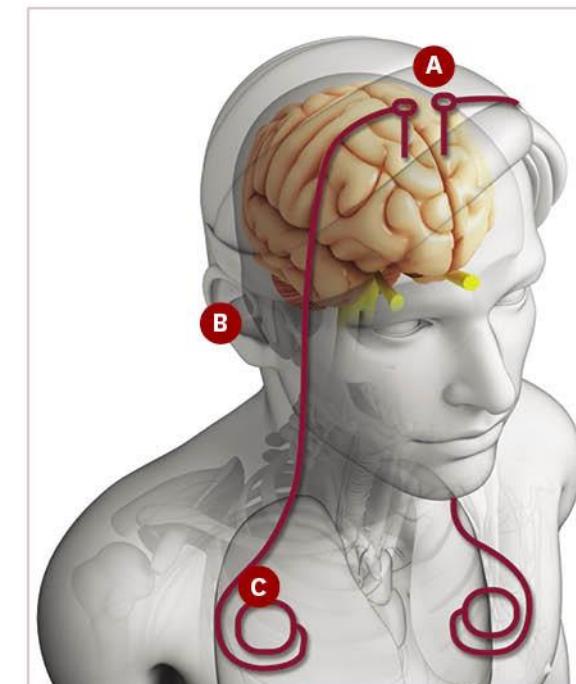
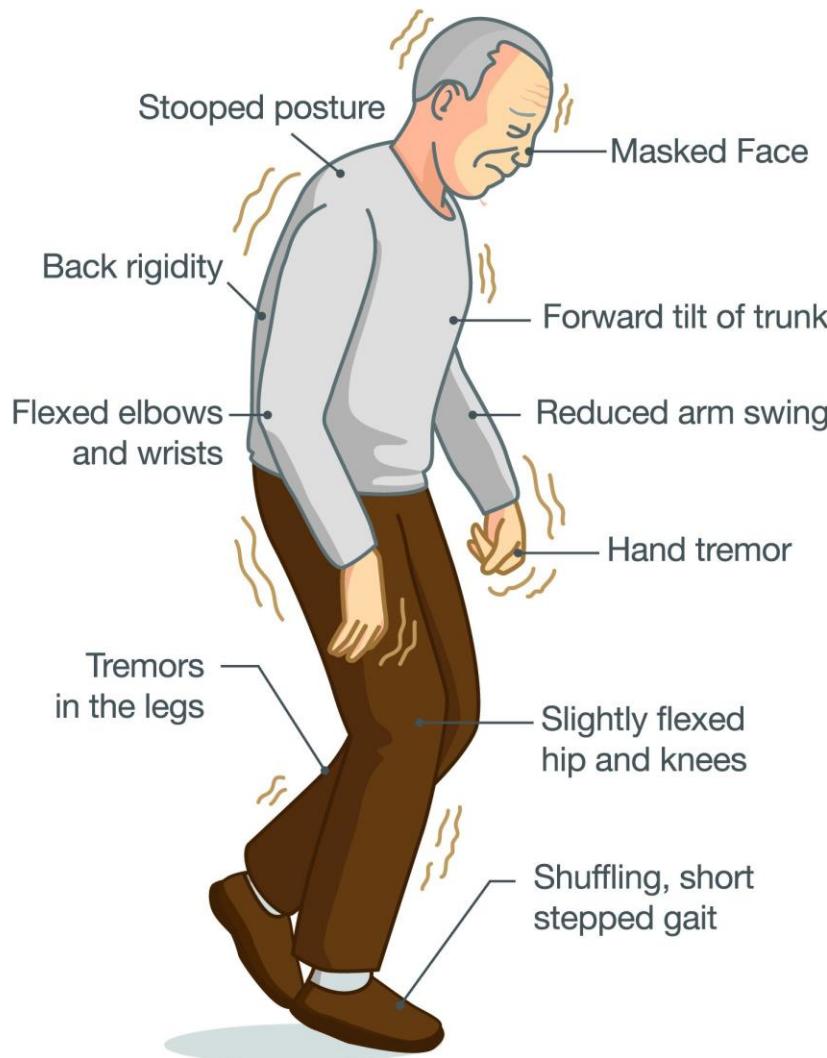
- Control, planning and monitoring movements
- Nuclei relevant to motor function
 - Striatum[Caudate, putamen], globus pallidus.
 - Substantia Nigra of the midbrain [Dopaminergic neurons]
 - Subthalamic Nucleus in thalamus [Relay]



Parkinson's Disease



Parkinson's Disease Symptoms



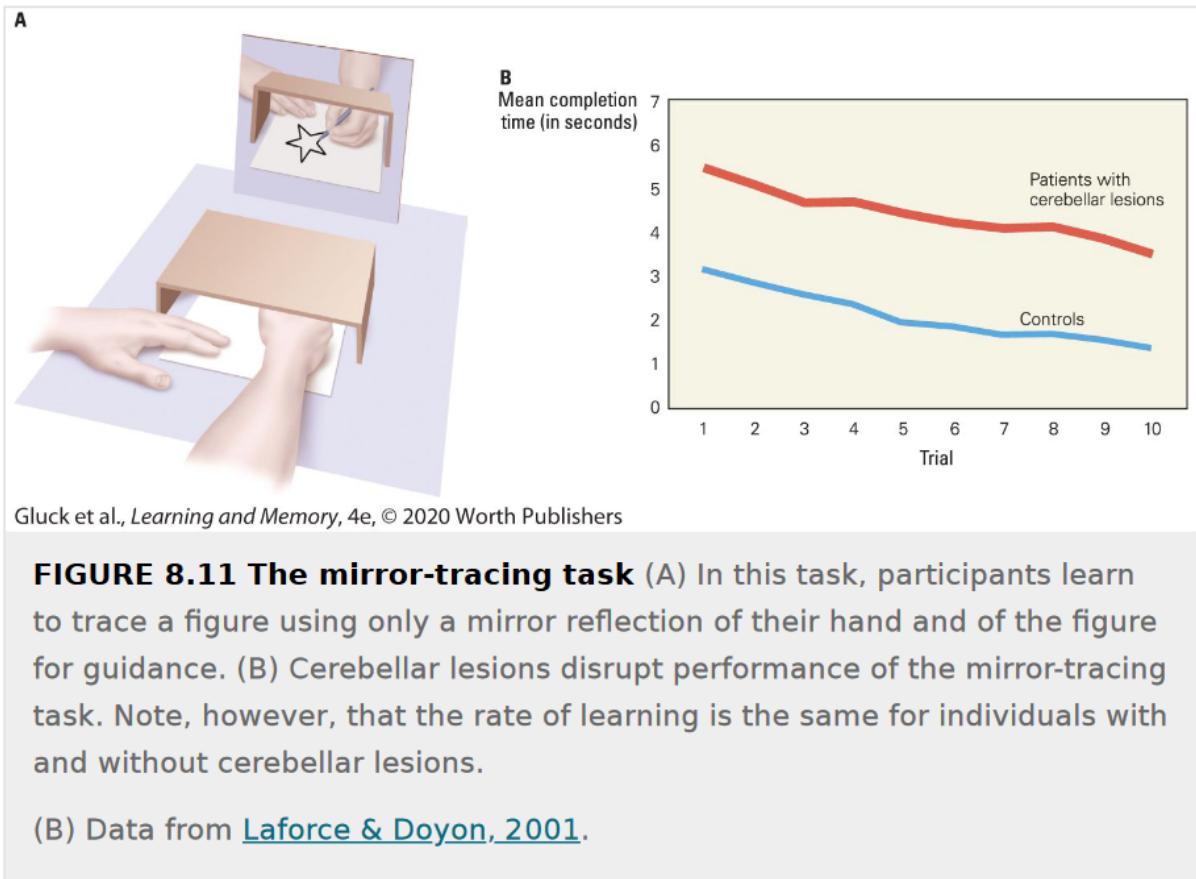
DEEP BRAIN STIMULATION: HOW DOES IT WORK?

Keck Medicine of USC

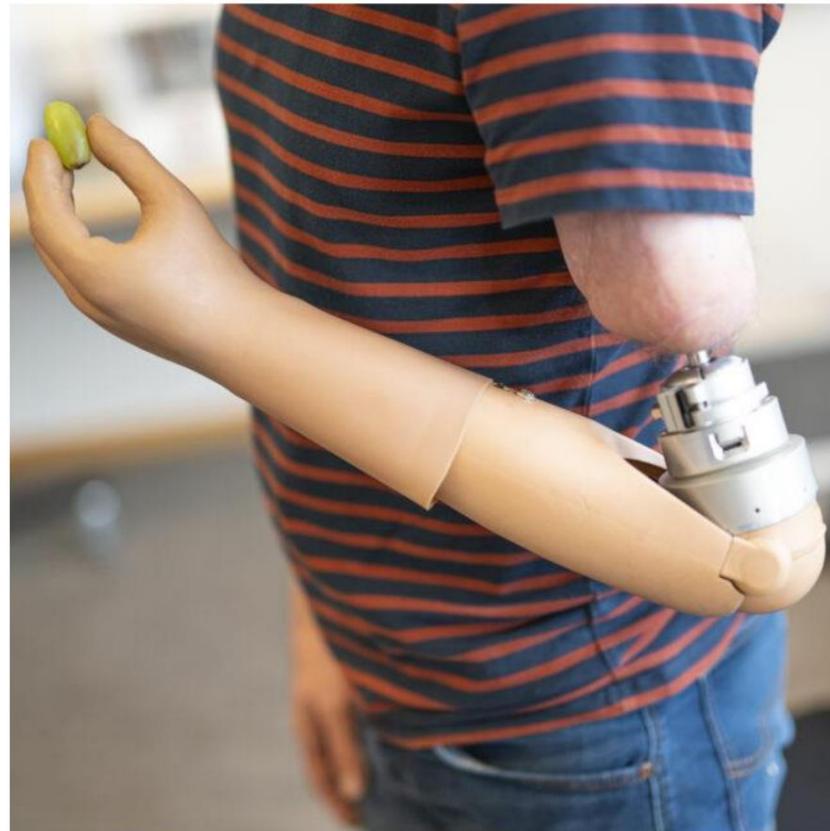
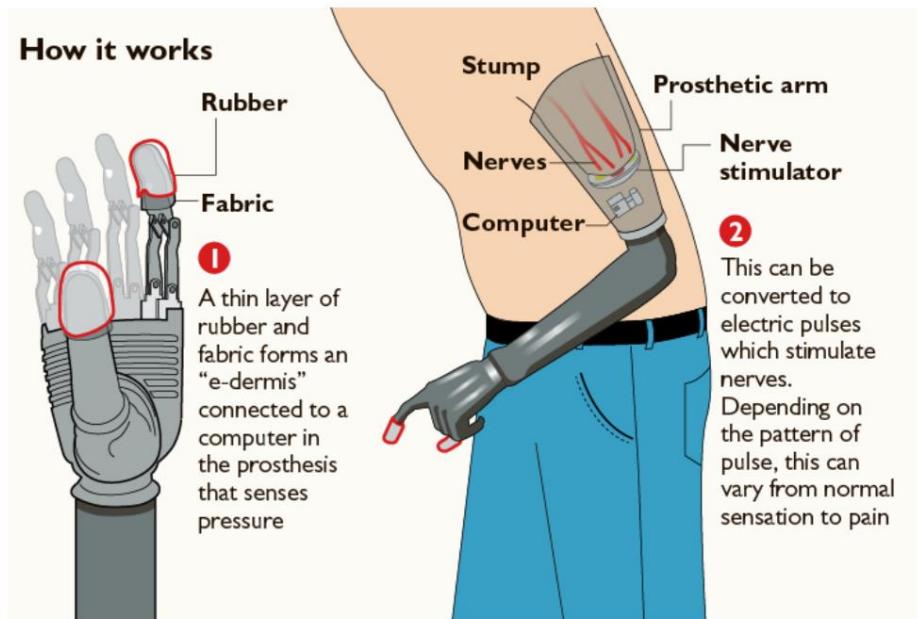
KeckMedicine.org

Cerebellar

The cerebellum plays a major role in adapting and fine-tuning motor programs to make accurate movements through a trial-and-error process



Controlling artificial limbs



Quiz-6

1) Shyam is learning how to play the piano. Initially, he had to focus intently on which keys to press and when to press them. Over time, he can play familiar songs without thinking much about the individual keys. According to Fitts and Posner's Model of Motor Learning, in which stage is Shyam when he can play these songs without much conscious thought?

- A) Cognitive Stage
- B) Associative Stage
- C) Autonomous Stage**
- D) Sensory-Motor Stage

2) Sheetal is practising archery in an indoor range, where the target is stationary. Later, she participates in a hunting competition, where she needs to adjust her shots based on moving targets and changing weather. What type of skill is Sheetal practising during the competition?

- A) Closed Skill
- B) Perceptual-Motor Skill**
- C) Cognitive Skill
- D) Open Skill

3) Two groups of students are learning to play a musical instrument. Group A practices for one hour every day over two weeks, while Group B practices for seven hours on one day each week. After two weeks, Group A performs better than Group B. What principle explains why Group A performed better?

- A) Power Law of Practice
- B) Massed Practice Principle
- C) Distributed Practice Effect**
- D) Associative Stage of Learning

4) There was a bike accident on the ORR. The biker's head hit the pavement but except for dizziness, he feels fine. You observe that he's unable to put on the buttons of his jacket.

What part of the brain must've been affected the most ?

Answer: Cerebellum

5) Which region losing dopaminergic neurons, causing tremors?

- Thalamus
- **Substantia Nigra**
- Hippocampus
- Globus pallidus