

Creating or Restoring Procedural Memories

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Semantic, episodic, procedural memories

Semantic - Facts

Episodic - Events

Procedural - Movements

All three can have conscious and subconscious components

Movement in the background

- Developing skills and habits without attention

Three Types of Memory

- **Semantic**-declarative, facts
- **Episodic**- declarative, autobiographical
- **Procedural** – implicit, nondeclarative, automatic

What is affected as adults age?

- ***Semantic*** - encoding affected some, storage and retrieval not usually affected
- ***Episodic*** - encoding affected, storage and retrieval not affected very much
- ***Procedural*** - not affected*

* Learned non-use (pruning) forgetting movements/strategies without recent experience

What is a procedural memory?

Do we hardwire all movements (procedural representations)?

Do we store experiences/situational options?

What is gained by storing the programs and basic constructs (forces, kinematics, synergies) for some movements?

Examples of Procedural Memories

- Getting into and out of bed
- Using an assistive device (cane, walker)
- Dressing a familiar shirt
- Brushing teeth
- Using crutches
- Using a wheelchair
- Putting brakes on a familiar wheelchair
- Cutting food
- Using a spoon or fork
- Swallowing
- My signature

What is the optimal route by which we shape our skills?

Watch

Attempt

Listen

Self-correct

Practice, self-correct, reward

Reward or failure to a personally satisfying level

What does it take to make a procedural memory?

Repetitions - often inflated by importance

Intensity - does not mean VO2 max, bpm, sweating

Attention - actually requires distraction, dual-task

Awareness (self-monitoring) - without internal focus

Purpose, desire, motivation - one if not all of these

Reward - nothing stronger than success w struggle

What does it take to make a procedural memory?

Mandatory

Intensity

Repetitions

Ideal

Superimposed distraction

Motivation* (reward > penalty)



How did you learn *these* skills?

Walking

Zippers

Buttons

Brushing your teeth

Tie your shoes

Play a musical instrument

Dribbling a soccer or basketball

What does it take to *re-make* a procedural memory?

Repetitions

Intensity

Attention

Awareness (self-monitoring)

Purpose, desire, motivation

Reward

What factors facilitate procedural learning?

Early success, not 100%

Reward: External (financial, praise, promotion, award, food, social)

Internal (gamification, satisfaction)

Cohorts and groups: people we can identify and/or compete with

Gamification: engagement with numbers, points, levels

Pre-task engagement or identification with the event, process, game

Permission to take risk without disastrous consequence

Time passing without movement being accessed

Procedural memories in postural control



Novelty

Novelty helps to expedite procedural memory formation

Novelty causes us to pay greater attention, elevating our interest and engagement

Reward systems are stimulated by success in novel tasks

Variability

Variability is a necessary condition for optimal function.

Error can optimize a change in motor control, “There is a significant increase in variability of a movement just prior to a change to a new movement pattern”

(Shumway-Cook, 2022)

Adaptability

We need adaptability in life's daily mobility:

- Mobility
- Driving
- Work
- Sport

Training Adaptability

- Varied practice
- Practice – delay – retention
- Circuit training
- Dual task
- Personalization

Ecological Dynamics

Allowing the individual the time and space to solve the task

Benefits:

- Active learner
- Confident learner with self efficacy in the end
- Fosters adaptability

Drawbacks:

- Learner may solve the problem with the “wrong” solution
- Time
- Frustration

(Gibson, 1966; Lee & Young, 1986; Shumway-Cook, 2022)

Summary: Procedural memories

- Repetitive – random within session
- Intense (skill or exertion)
- Success at a rate that satisfies this learner
- Errors – keep the learner striving

- Salience (meaningful, interesting for this person)
- Overload (dual task), drawing attention from the task
- Active learner (provides feedback to themselves)
- Recall, rehearsal after a delay

R I S E + S O A R – biking, typing, tying shoes, dribbling, buttoning

Up Next

- Next, we will discuss ***Using Cognitive-Motor Interference as a Stimulus for Learning***