

Using Cognitive-Motor Interference as a Stimulus for Learning

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The Science of Motor Learning

What we have learned so far:

- Feedback
- Practice
- Repetitions
- Intensity
- Engagement

The Science of Motor Learning

What we are going to learn in this session?

- **Why** we use DT to solidify motor learning
- **How** to use dual tasking to improve motor learning

Why we use DT in motor learning

“According to the ‘Use it or Lose It’ principle of neuroplasticity...many older adults become intolerant of distractions, because they no longer experience distractions regularly.”

Why we use DT in motor learning

A reduction in dual-task interference may be achieved via at least two possible mechanisms:

(1) improving automatization (reducing the attentional requirements of gait)

(2) improving dual-task coordination by (overloading) task-specific training

Plummer, 2012

How we use DT in motor learning

Dosage

- Novelty
- Volume
- Pressure

Representing real-world environments

- Cognitive
- Visual
- Auditory
- Motor

Novelty

Participating in something new, requires:

- Attention
- Motor programming
- ...a desire to repeat and compete again

Volume

- Repetitions
- Magnitude (amount of distraction)
- Success

Pressure

- Time or outcome-based challenges
- Consequences
- The effect of pressure on success –
Fear, self efficacy, confidence, motivation

Errors

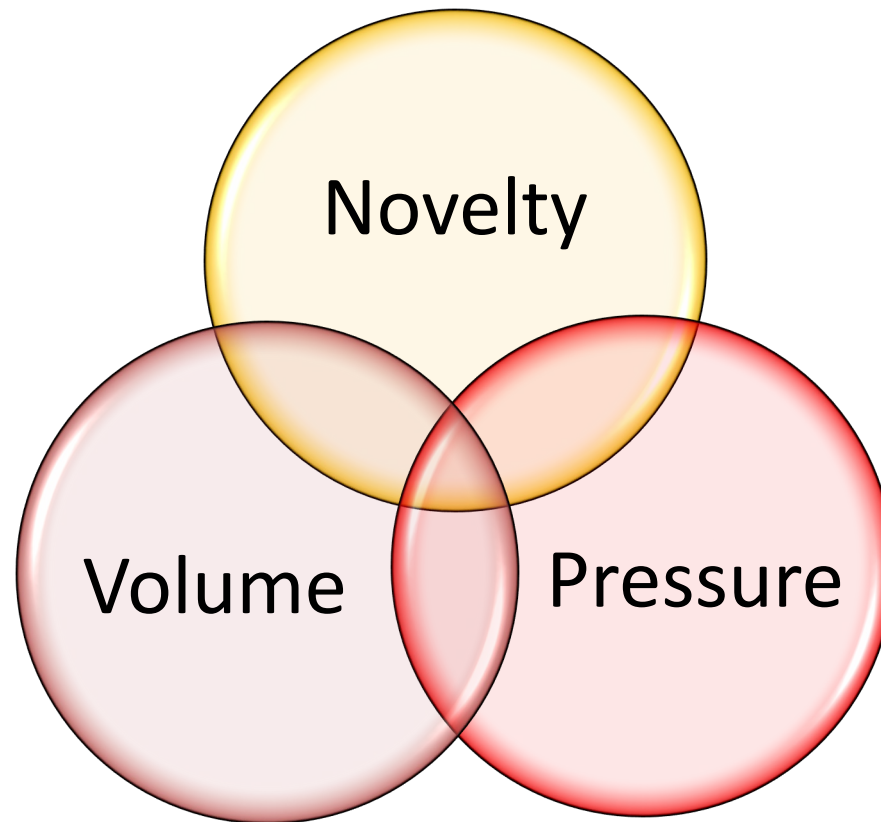
- Error rates must be personalized
- Consequences must be acceptable

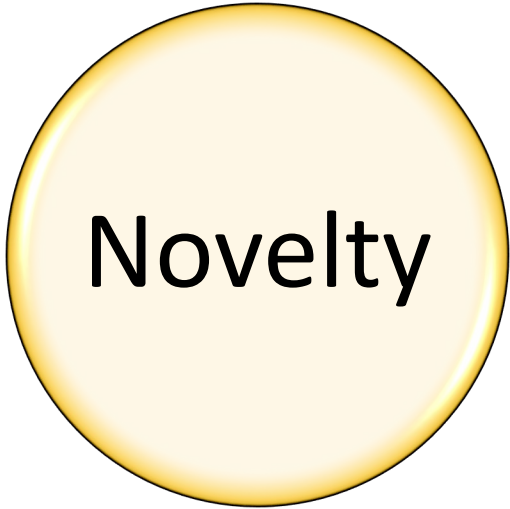
Errors

Rate of perceived
difficulty in DT

NO CHALLENGE, FAMILIAR	1
EASY, BECOMING BORING	2
COMFORTABLE	3
WINNING TOO OFTEN	4
LET'S MAKE IT HARDER	5
I'VE GOT THIS!	6
CHALLENGING BUT DOABLE	7
SURPRISED WINS!	8
ALMOST TOO HARD	9
FEELS LIKE I AM FAILING	10

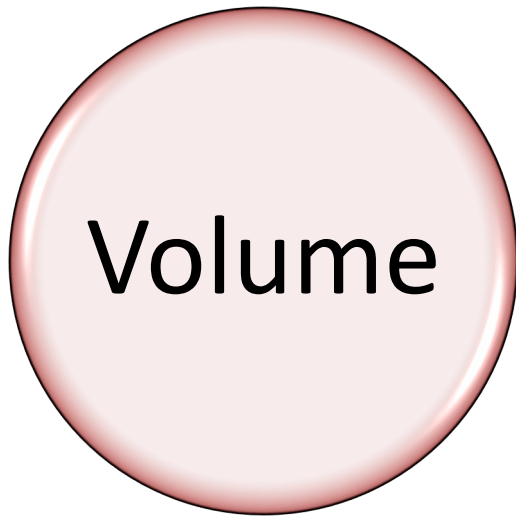
Three variables of cognitive (DT) intensity





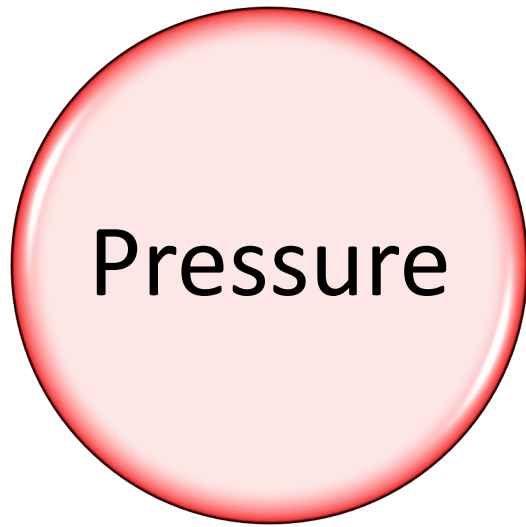
Novelty

- Offensive or defensive configurations
- New city/town to drive in
- Hotel room, cabin, new residence
- Task constraints (players on field)
- Dimensions of field
- Number of dribbles, kicks, passes
- New pet, grandchild
- New car, shoes, cane, walker, bed
- Scoring rules (backboard, aspect of goal, #s)
- Teammates
- Opponents



Volume

- Amount of sensory processing (lights, sound)
- Duration (play, half, game, between rotations)
- Amount of information
- Working memory (holding tank) amount/data
- Multi-task physical (manual or otherwise)
- Physical load (weight vest)
- Steps in a sequence (directions to a store)
- Length of field, court to cover
- Increased responsibilities (opponents to cover)



Pressure

Time constraints on possession

Shot clocks

Time between pitches, plays

More people guarding you

Traffic signal time allowed

More defense on the pitch, field, diamond

Faster play, advantages to opponents

(pitching mound closer, defense offsides, etc)

Impatient caregivers

“Trash talk” and other targeted distractions

Constraints on your team, handicaps

Consequences (incontinence, embarrassment, fall, MVA)

Timing

- Is everyone ready for dual tasking?

Dual Tasking: Modes

- Cognitive
- Manual
- Auditory
- Visual

Dual Tasking Modes: Manual

- Task-related with manipulation
 - Phone
 - Wallet/purse
 - Toothbrush, medications
- Functional/gross motor: carrying clothes, plate, cup
- Sport-specific manipulation of ball, bat, stick, glove

Dual Tasking Modes: Auditory

- Feedback
- Coaching, advice
- Technology (biofeedback)
- News program/podcast/sports broadcast
- Course/audio book
- Conversation
- Music*

Dual Tasking Modes: Visual

- Glare
- Sudden movement in visual field
- Phone, texting
- Media
- Conversational eye contact
- Environmental (not relevant to the task)
- Lamellar flow (traffic, walking, running) in your peripheral visual field

Dual Tasking Modes: Cognitive

- Self talk
- Mathematical operations
- Sequences/directions
- Ingredients/lists
- Appointments and future plans
- Upcoming or recent past conversation
- Trivia, musical artist

Dual Tasking Modes: Cognitive

- Hold
- Process
- Recall
- Generate



Hold

Players' names

Upcoming schedule

Next three plays to run

Recent scores or “today’s results”

Feedback (verbatim or summarized)

Sequence to a play (rotations)



Hold

Where did I park my car?

What did she say her name was?

Order me a Caesar salad please

Turn left on 1st, then right on Birch, and R on 2nd

Grandpa, remember what I told you about school?

Where did I see that bathroom earlier?

Process

Situational gameplay: “man on 2nd, 1 out”

Substitutions, now name who is on field

Permutations, “if they ____ , then we_____”

Next three plays to run

See defense, plan for offense

If these eight are on the bench, who is starting?

Which player on the roster was not named?

Go-No-Go decisions, relevant to most every sport

Process

Who is missing from this invitation list?

Do I have enough gas?

Can we make it there on time?

Is my paystub correct?

Will I need more flour to double this recipe?

Is that too tight of a connection?

How many calories have I spent/eaten today?

Which is the better deal (\$/volume considerations)

If they have a left turn signal on, can we go?

Where else could our dog be?

Recall

Teammates uniform numbers

Previous results for your team

Last year's roster or opponent's roster

Scores/results

Who you guarded

Highlights, awards

Last 4 plays of the game

Facts retrieved from pre-injury

Facts retrieved after injury

Recall

Relative's phone numbers

What you like on this menu/ordered last time

Neighbor's name or dog's name

Who paid last time

Appointments coming up

Which episode we watched last

What route we took to get there

Items that I do or do not have on hand/pantry

Old addresses

Generate

Category naming

Cities

Professional teams

Items/words related to this sport

Things to take to watch a game

Food commonly sold at stadiums

College teams

College mascots

Shift to another sport, same lists

Generate

Solutions for being locked-out

Communicate without cell phone

Rerouting: Traffic or construction

Reusing items, tools, clothing

Alternate words/word-finding

Outfit when favorite needs laundering

What to make for dinner

Principles/tenets of dual task rehabilitation

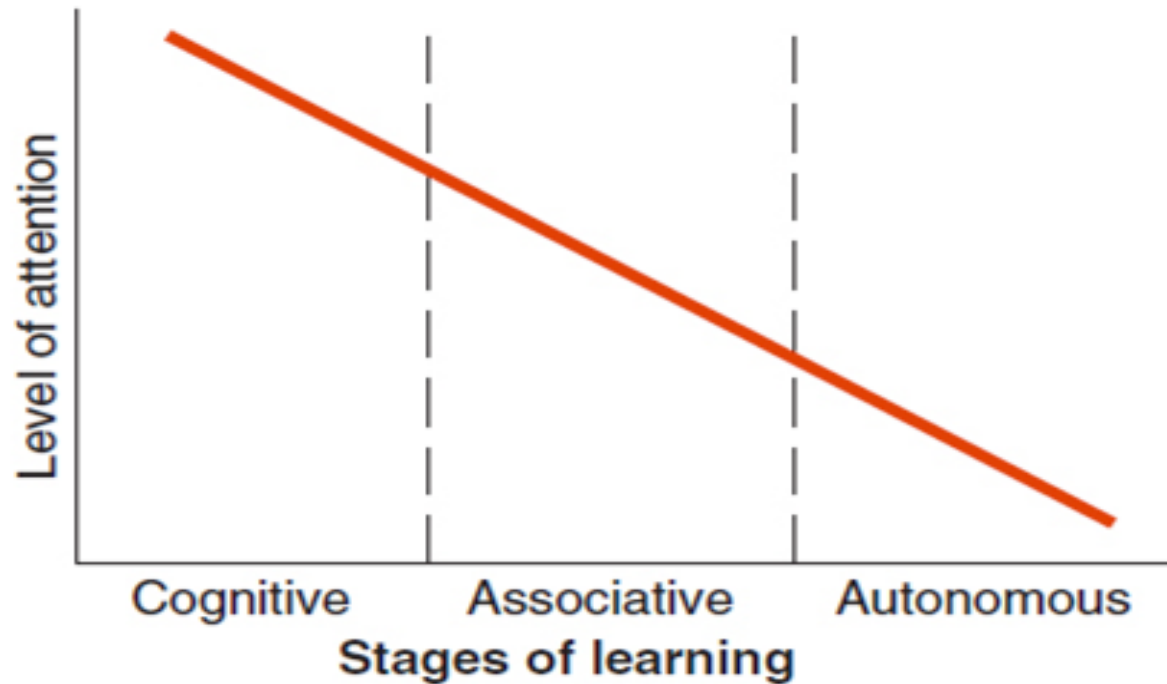
- Task specificity to the type of distraction (mode)
- Intensity matters
- Timing of learning/re-learning motor skill matters
- Cognitive capacity matters
- Novelty matters
- Complexity matters
- Prior experience/procedural learning matters

Prioritization

- Skilled performers, athletes, workers can prioritize within an individual-task-environment equation very quickly
- Prioritization is a function of awareness that can be trained in most cases

Timing

- Is dual tasking for everyone?



Up Next

- Next, we will discuss ***Measuring Cognitive-Motor Interference: Dual Task Cost***