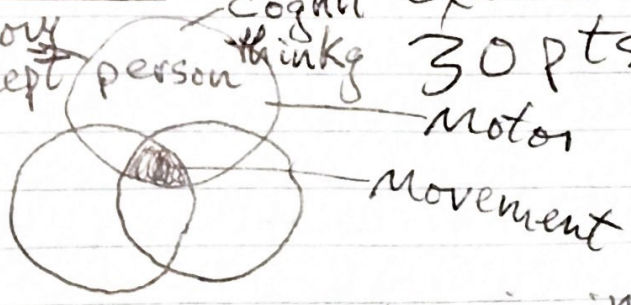
484 Pain changes the way we move
LT changes in the way we plan our mvmts

SEPT 13 2017 Motor exam Wed 20TH

Flashcards
Make your own
Study Guides



30 pts Exam

COGNITIVE PROCESSING

brain imaging during vol

Motor Action

Sensory perception

GOAL DIRECTED MVMT

perception
- visual cortex
- somatosensory Cortex
- parietal lobe - attention

Action
- Supplementary Motor Area
- premotor Cortex
- primary
- BG
- Cerebellum

Cognition
- Insula (sense of self)
- Cingulate Cortex
- dlPFC dorsolateral prefrontal Cortex

limbic response emotional

Decision making

Apkarian 2005 6 most common reported regions in pain literature

x4 involved w/ MVMT

Anterior Cingulate Cortex
Sensory Cortex 1
Sensory Cortex 2
Insula
Thalamus Relay Station
Prefrontal Cortex

484 9-13-17 Motor Phoenix Gryphon

MM, Ligaments, tendons, bones.
Immune Response to Repair Damaged Tissue
- swelling
- Thermal + Mechanical pain
↓ use of injured site

Pain Neuro

"FEED-FWD" is "OPEN LOOP"

Compensatory Movement Patterns

Altered pain input + subjective experience of pain → change in organization of MVMT
learned aversive relationship with that task
reinforced poor expectations of performing that task

learned disuse to avoid pain Corderre et al 1993

Phoenix
Gryphon

MOTOR WK 4

COGNITION & ACTION

Fall 2017
KINS 484

Learning Outcomes

- Students will be able to:
  - *Differentiate between open and closed loop control of movement*
  - *Understand the value of attention and motivation in motor learning and development*
  - *Identify and describe key structures of the central and peripheral nervous system as they relate to movement production (Wednesday – Friday)*

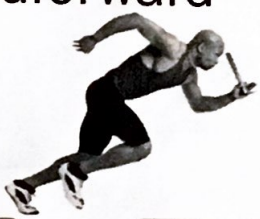
MOTOR
WEEK 4

OPEN VS. CLOSED LOOP CONTROL OF MOVEMENT

mm brain telling body what to do
force

Open Loop Control = feedforward = top down

down



Sense → Think → Do

Stimulus Identification → Response Selection → Response Programming

MOTOR WEEK 4

sense think do

Closed Loop = using sensory feedback

Stimulus Identification

Response Selection

Response Programming

Muscles

Reference of Expected Results

cerebellum

Movement

Environment

Feedback from movement sensation (interoception) and from the environment (exteroception).
-Was there a difference between what I expected and what actually happened?

exteroception

on the fly adjustment

did expectations match reality

Reference of Expected Results

Stimulus Identification

Response Selection

Response Programming

Muscles

Movement

Environment

Reference of Expected Results

If the feedback matches what was expected, the movement was done correctly and no adjustments are necessary

If there is a difference between the feedback received and the reference, then an error is signaled and a correction is required

Brain → Body and back is closed loop

open →

MOTOR WEEK 4

using sensory feedback

Open Loop vs. Closed Loop

discrete task

- Open Loop –
  - *Softball pitch*
  - *Hitting the ball as a batter*
  - *Letting go of the bow in archery*
  - *Casting a fishing line*
- Closed Loop –
  - *Driving a car*
  - *Skateboarding, Surfing*
  - *Aiming in archery*
  - *Reeling in a fish*

skilled at doing this with sensory inputs are intact

Rocky Path = make corrections

GET INTO GROUPS OF 4

Assign people into:

1. sensory – 2. thinking – 3. doing – 4. expectations of movement

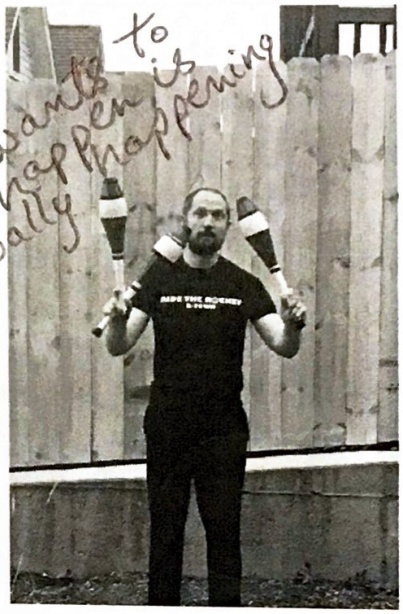
MOTOR
WEEK 4
9-11-2017

adjustments
corrections
=closed loop

Expectations = Reality

sensory
vision vestib
tactile proprio
auditory

rotation
pattern wants to
have happen is
actually happening



- What did he expect to happen?
- What are the primary **senses** he is using?
- What **does he** have to **think** about? how much force
- What did he **do**? throwing and catching and watching

Keep a
rhythm
speed

bal
in
standing
position

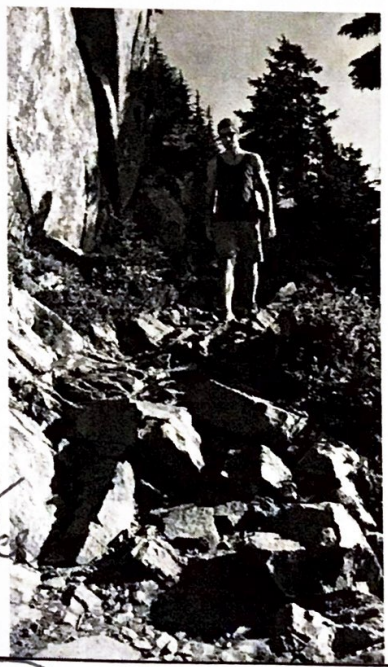
WK1
Continuous
Task

WK1
quasi-open

Sensing

Smooth pursuit = keep eye

Expectations ≠ Reality



thinking, stay up

Closed
Loop
Control

not to fall
rocks won't move

- What did he expect to happen?
- What are the primary **senses** he is using? vision, vestibular, PROPRIOCEPTION (to mm spindle)
- What does he have to **think** about? regain bal arms up
- What did he **do**? walking

tactile in feet

thinking
how do

think
foot
place

how
make
corrections

thinking
consciously
balancing

where
is stable
ground

force
stretch

unpredictable
open
environment

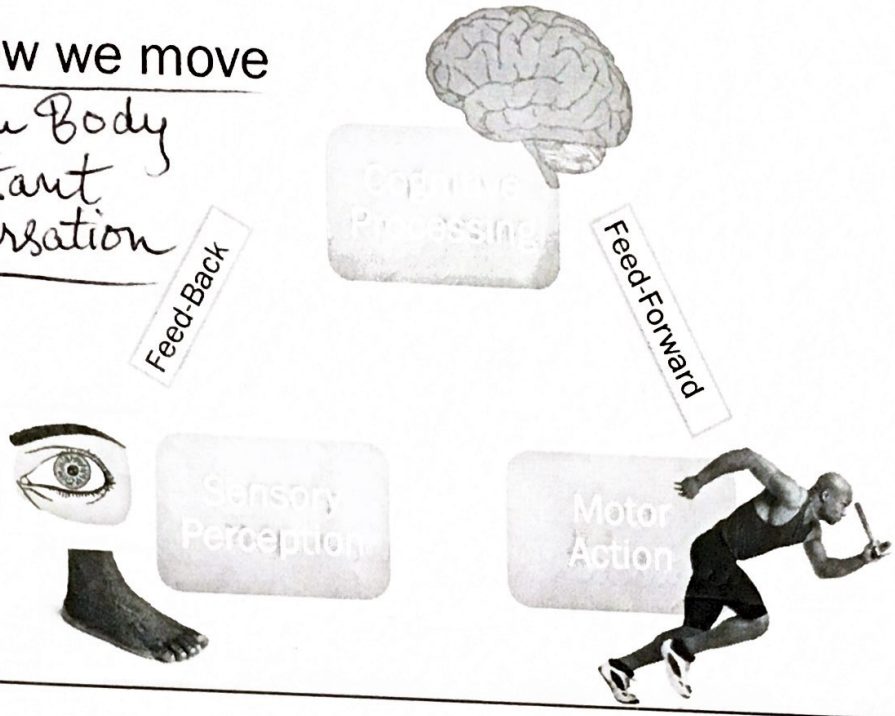
REFLEX

1° Stim / what is right response / do what you told body to do

9/ Mo WK 4

How we move

Brain Body Constant Conversation



Expect Match Reality

Open & Closed Loop Control Summary

- Open Loop (aka Feedforward) control of movement:
  - *The brain tells the body what to do*
  - *The body does what it has been instructed to do* ***without the possibility of correction in case something goes wrong***
- Closed Loop (aka Feedback) control of movement:
  - *The brain tells the body what to do* ***and constructs a "reference" for what it expects to feel once the body does what it is told.***
  - *The body does what it has been instructed to do and sensory feedback from the movement is compared to the "reference" of expected results*
  - *If the sensory feedback matches what the brain expected, we don't need to change.*
  - *If the sensory feedback DOES NOT match what the brain expected, we become consciously aware of the error and make a correction.*

WE ARE CONTINUALLY CONSTRUCTING LITTLE ANTICIPATORY PATTERNS IN OUR BRAIN TO HELP US PREDICT THE FUTURE: IF I SMILE, THEN SHE'LL SMILE.

IF OUR MODEL MESHES WITH WHAT ACTUALLY HAPPENS, WE EXPERIENCE A LITTLE DRIP OF SWEET AFFIRMATION.

IF IT DOESN'T, THEN THERE'S A PROBLEM, AND THE BRAIN HAS TO LEARN WHAT THE GLITCH IS AND ADJUST THE MODEL.

David Brooks from "The Social Animal"

ATTENTION AND MOTIVATION

Why would you pay attention to one thing over another?

Attention:

- **Top Down Attention (Open Loop):**
  - *Look at the door*
  - *Look at your phone*

- **Bottom Up Attention (Closed Loop)**

  - *Look at the door because someone just opened it unexpectedly*
  - *Look at your phone because you saw it light up, letting you know you just got a text*

Attention & Motivation

Describe a time when you were motivated to pay attention

Attention to Errors

- **When expectations don't match reality,** we become consciously aware/our attention becomes devoted to that sensory perception.

ex) *Like when you're entering your password and it says you didn't submit the correct password, you're more likely to slow down and try it again.*

- **When expectations don't match reality,** we can learn from the disconnect to make the difference between expectations and reality smaller.

learn

9-11-2017

(*) expectation shapes reality

demands your attention

Attention to Pain

- **Attention** to **painful stimuli is prioritized** over other senses **to help protect** the body from ~~injury~~ injury
- Depending on the **intensity** and **perceived nature** of the threat, painful information could induce
  - *Quick reflexive movement*
  - ↓ *movement*

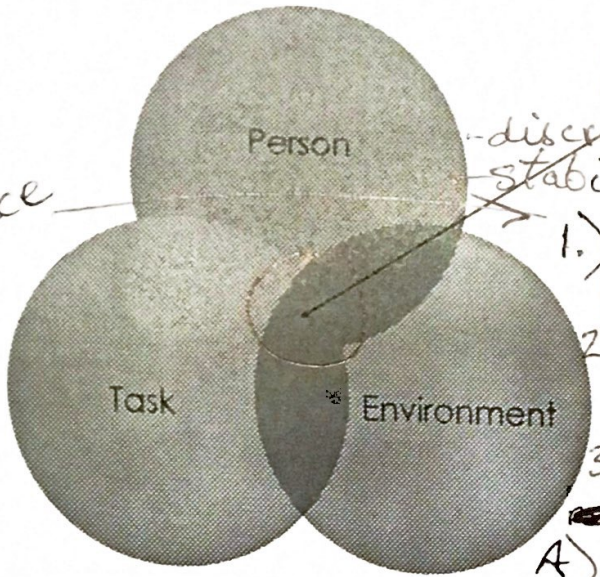
likely to decrease mvmt
constrained mvmt

Motivation

- What motivates us to move?
- Is it similar or different across the lifespan?
  - *Infants*: novelty = new = basic needs
  - *Children*
  - *Teenagers*
  - *Adults*
  - *Older Adults*
  - *Elderly*

PET MOVES

Movement emerges from the interaction of three factors:



(Motivation)
Movement

one sentence

- discrete, serial, continuous
- stability, mobility, manipul

1.) what three things make up MVMT.
2.) how are movement and motivation related?
3.) which one does ~~it~~ belong in task?

A) discrete, stability, ~~closed environmt~~ Continuous
B) Manip, Mobility, Stab Serial, Perception
C) Stability, MOBILITY, Manipulation, Discrete
D) discrete, open ENV., Serial, Continuous

open ended or outside surfing

3 wrong 1 right

Environment

- **Open:** Environment is constantly changing and unpredictable
  - Movement is more reactive
- **Closed:** Environment is stationary and predictable controlled
  - Movement can be planned in advance

writing samples
closed loop
muscle memory

motor cortex

Movement

Person – Task – Environment

Perception – Cognition – Action

Movement

- Movement and motivation share the same Latin root "movere"
- Why is that important?

Task (SIX)

go more detailed

Task

- **Discrete:** a distinct beginning and end
- **Serial:** a series of discrete tasks strung together
- **Continuous:** no distinct beginning and end; the task continues until the person decides to stop

Task

- **Stability**: the purpose of the task is to remain still (non-moving base of support)
- **Mobility**: the purpose of the task is to move your base of support
- **Manipulation**: the purpose of the task is to move something else

Person

- **Perception**: Perceiving the relevant environmental features
  - "Sense"
- **Cognition**: Decided what to do and where and when to do it to achieve the goal
  - "Think"
- **Action**: Producing organized muscle activity to generate movements that achieve the goal
  - "Do"