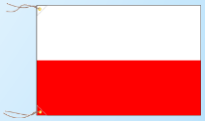
PNF and
Motor control/Motor learning Theory

How to apply Motor control/ learning theory in daily practice with PNF concept.

Beata Wnuk; Poland



Shingo Toda; Japan

Goal of this presentation

- PNF is not just facilitation method
  (changes in the concept)
- Motor control/Motor learning is one of the science area, it is not treatment approach
- How to apply science into clinical practice? (Theoretical basis for PNF approach)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What is the motor control

The term motor control refers to the study of posture and movement as well as the functions of the mind and body, which directs the posture and movement.

(Shumway – Cook, 1995)

What is the motor control

In studies on the nature and causes of movement we are talking about two problems - first, to stabilize the body in space, motor control of posture and balance, second - movement of the body in space-motor control on the movement

(Shumway – Cook, 1995)

Models of motor control

Reflex

Hierarchical

Motor programming (CPG)

Systems

Ekological

Dynamical action

etc.

Models of motor control

Different terapeutical approaches based on different models of motor control:

- Muscle reeducation
- Facilitation (reflex, hierarchical)
- Goal oriented (reflex, hierarchical, **systems**)

Systems approach

Movement is not the result of muscle – specific motor programs, or stereotyped reflexes, but result from dynamic interplay between perception, cognition, and action systems

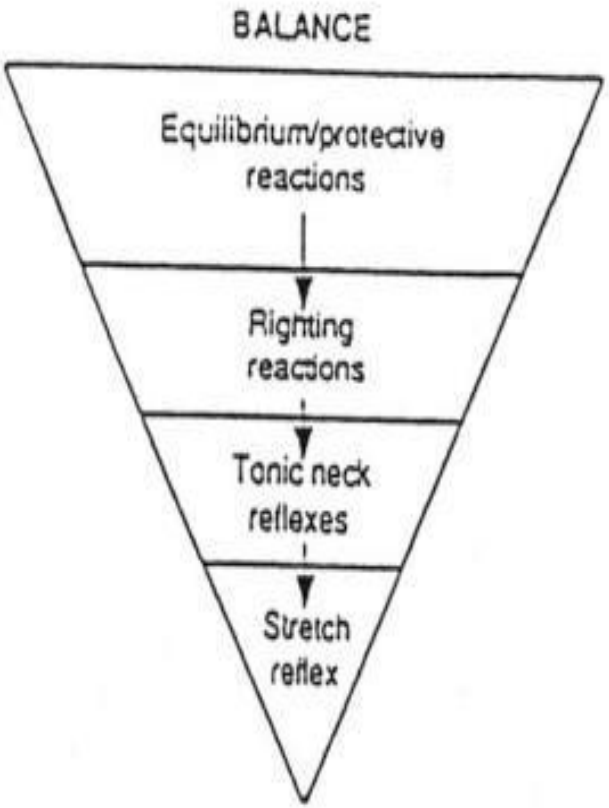
(Shumway-cook, Woollacott)

Goal oriented model

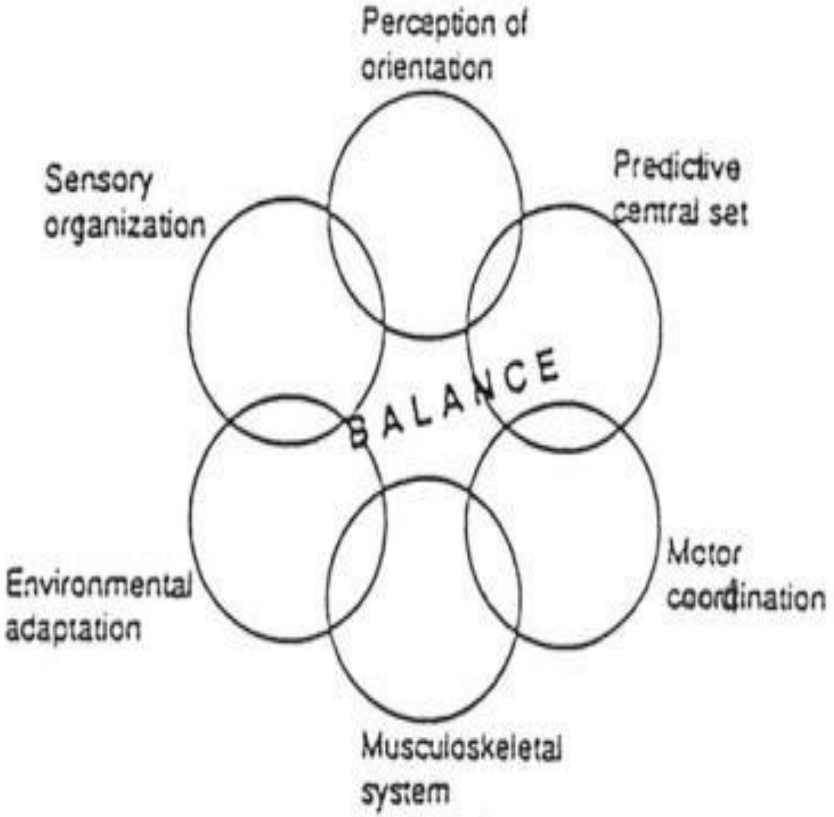
Control of the movement is organized around goal oriented functional behaviors, not just muscles and movement patterns. F. Horak 1991

EQUILIBRIUM

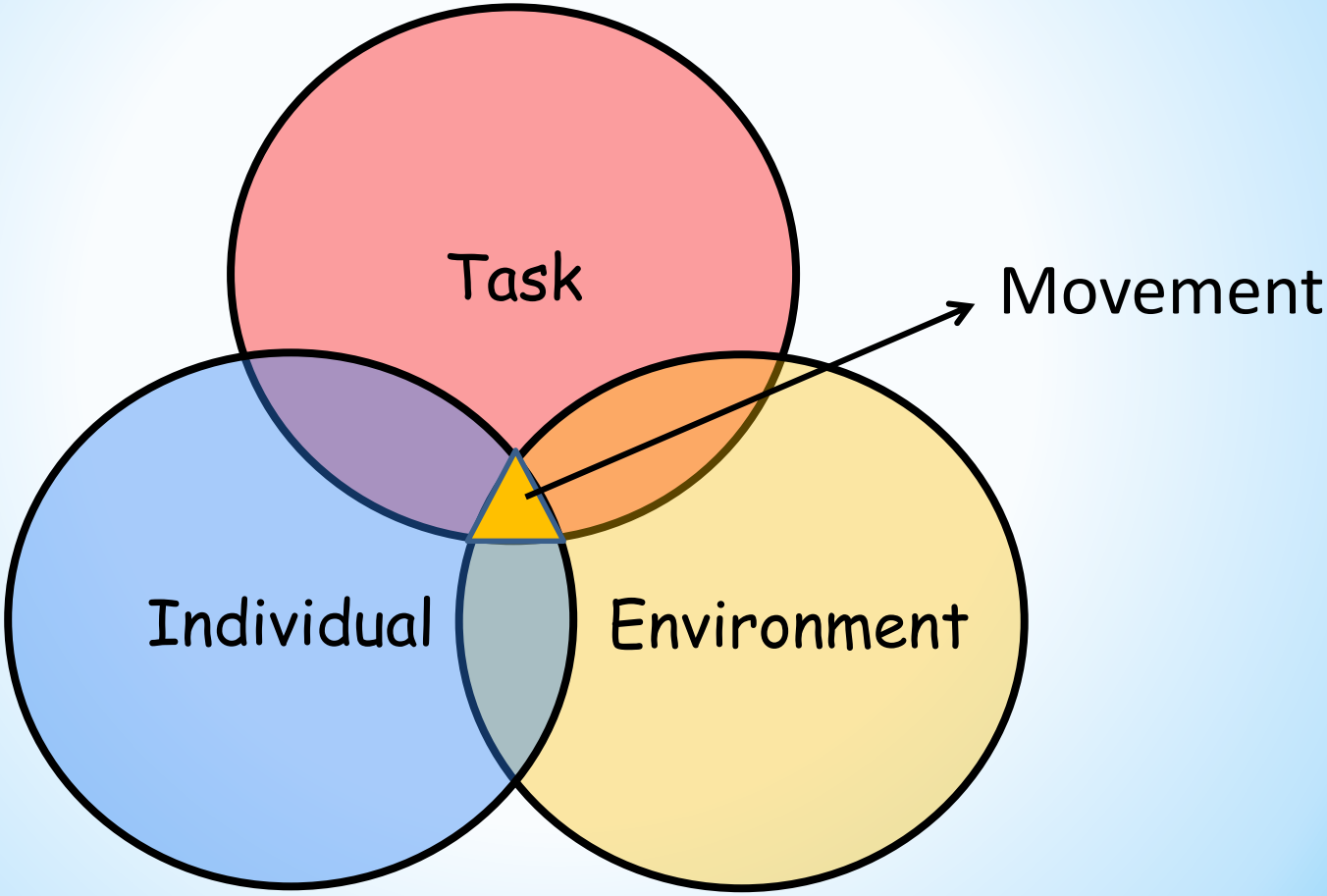
A. TRADITIONAL REFLEX MODEL



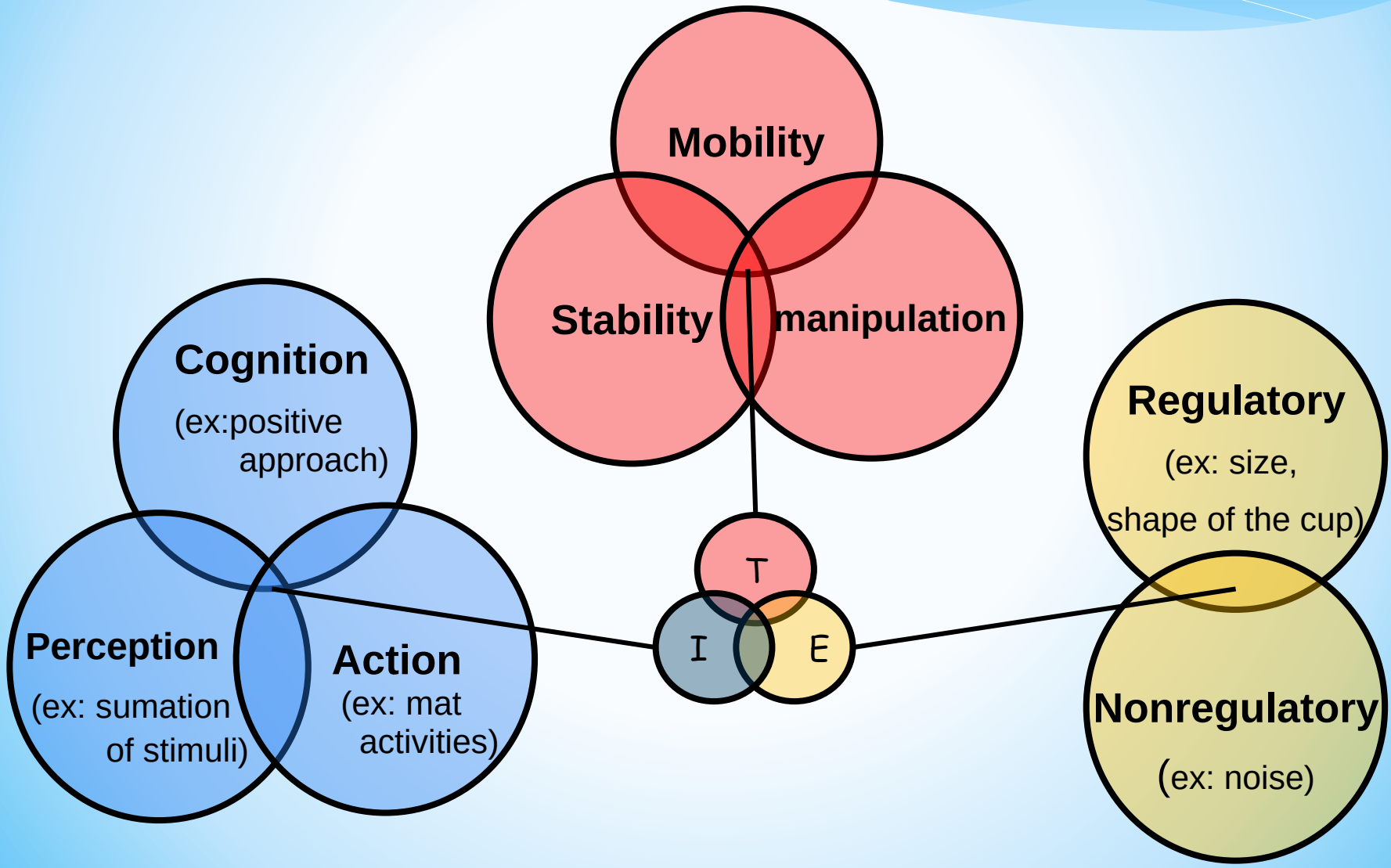
B. CONTEMPORARY TASK-ORIENTED MODEL



Nature of movement



Factors affecting the organization of movement



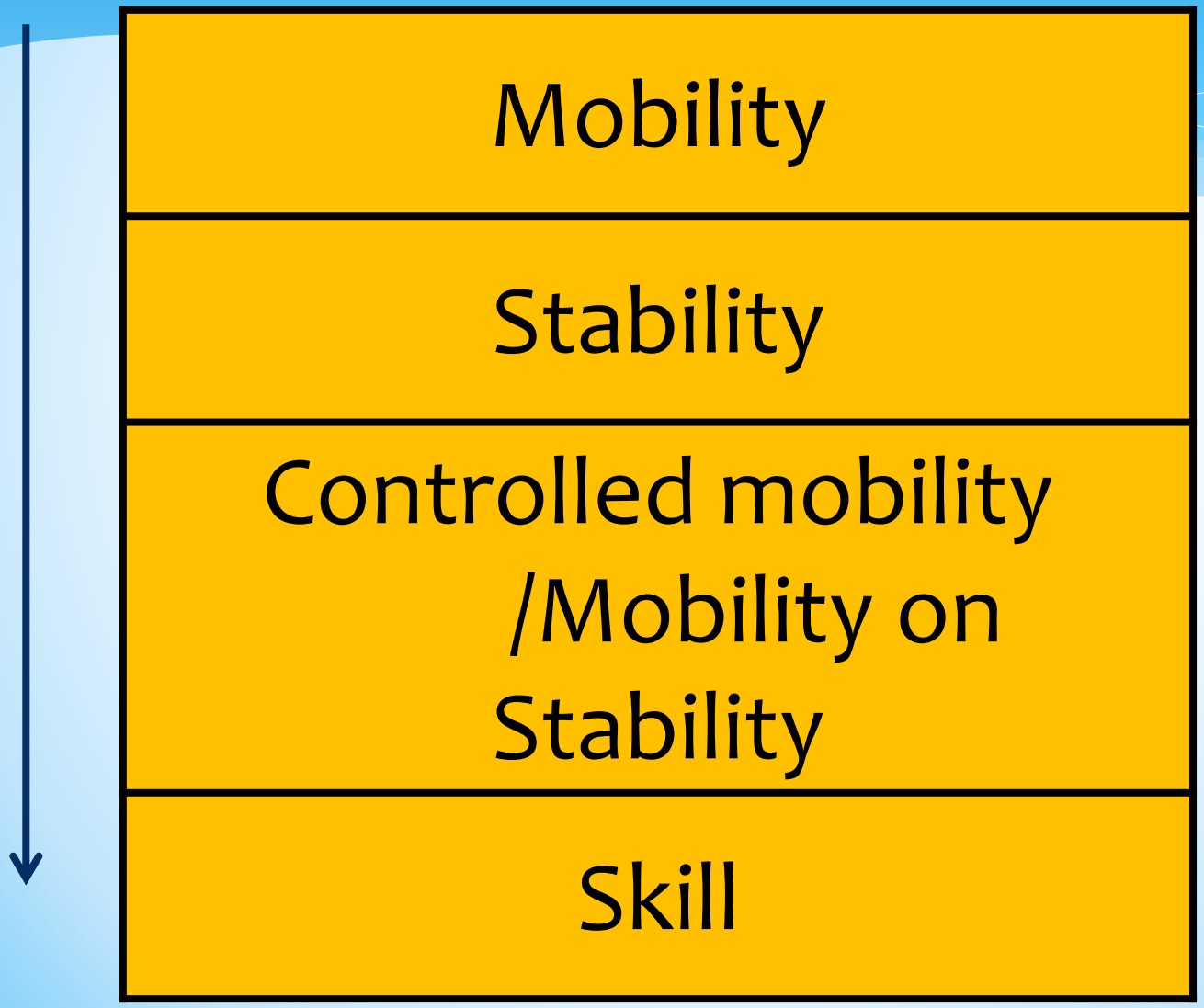
Movement? Postual control?

We need to work with patients to improve the movement for daily activities.

Patients need postural control for movement.

We can work acording to the stages of motor control

The stage of motor control



Mobility

Global, uncoordinated, aimless movements, poor antigravity work - newborn

Stability

- In between 8 and 10 month the child is able to sit independently, on the beginning upper limbs have a support function (stabilization) but when the trunk postural control became better they are free for movement

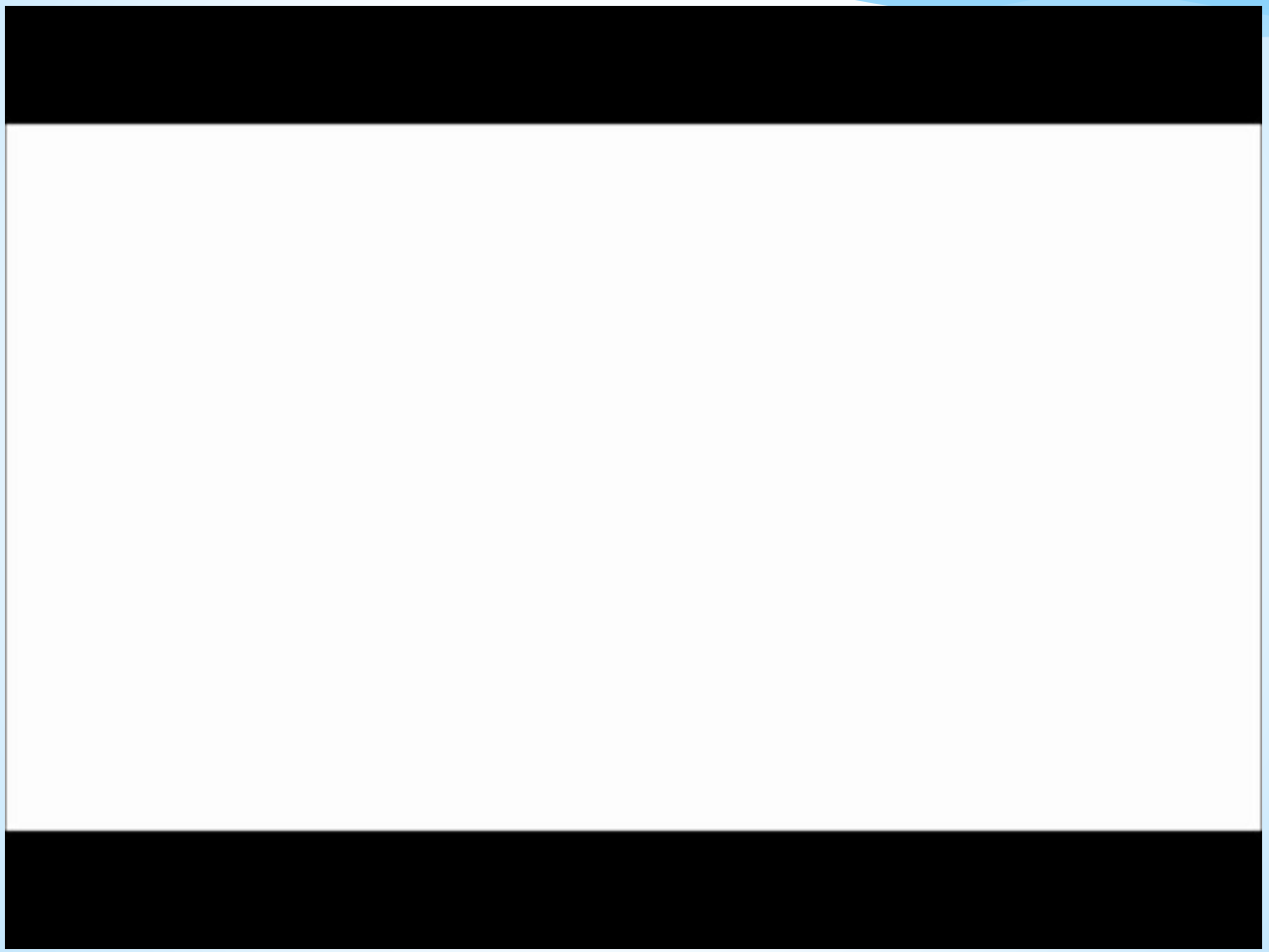
Mobility on stability

Stable sitting allows to free upper limbs for movement and development of manual skills.

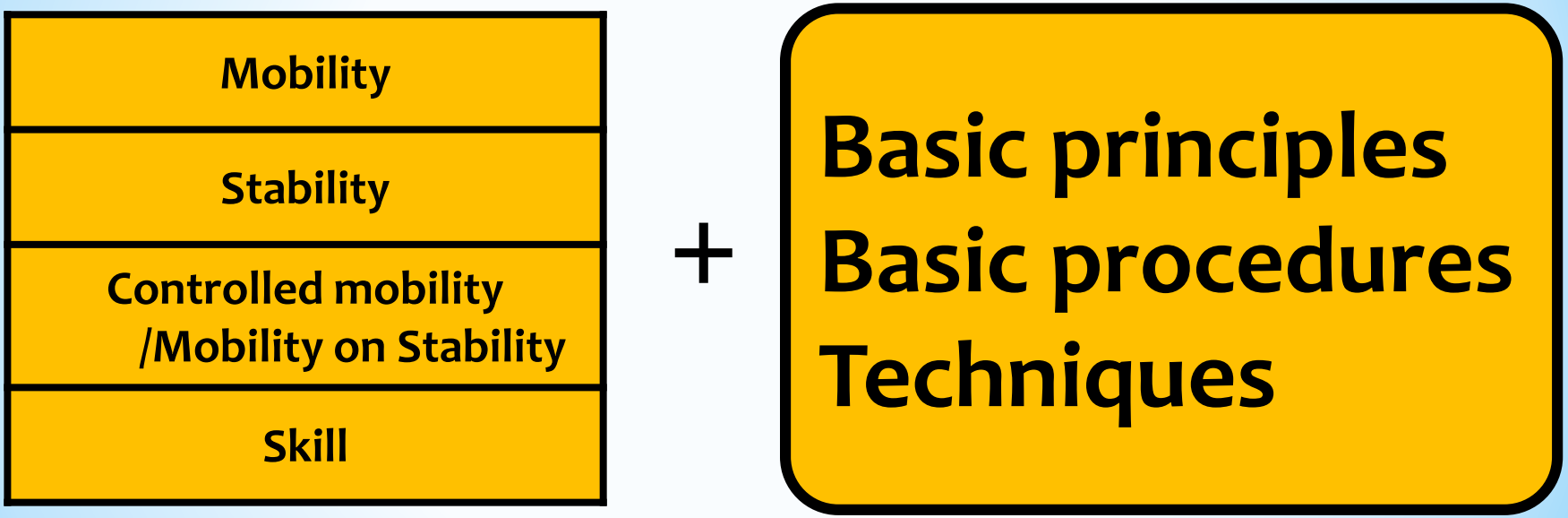
Skill

Total automatisation of sitting and multitasking.

The stage of motor control



How to apply?

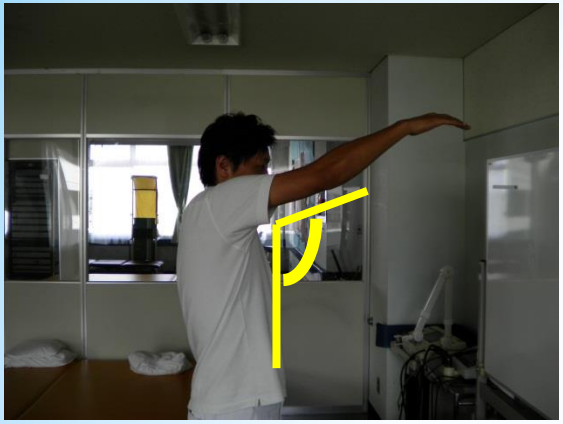

Mobility
Stability
Controlled mobility
/Mobility on Stability
Skill
+
Basic principles
Basic procedures
Techniques

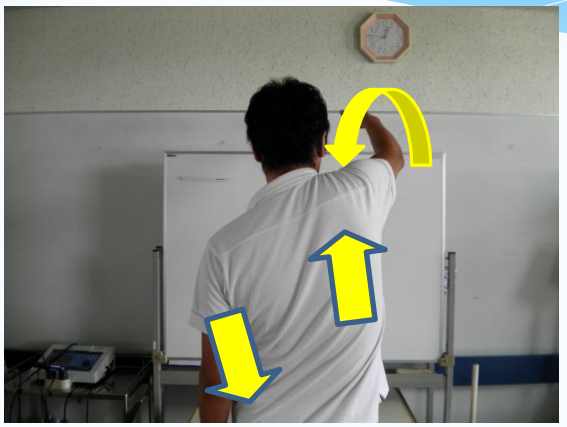
Stage of motor control with PNF concept

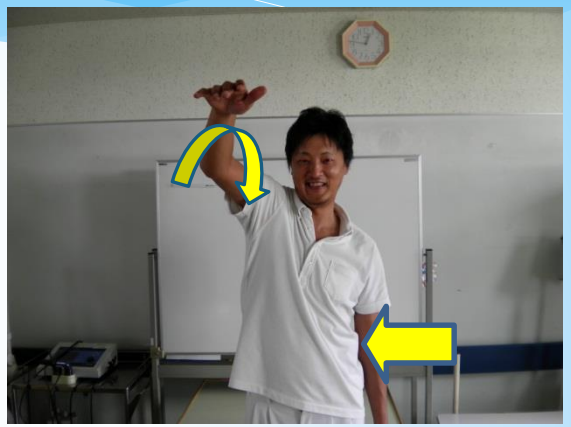
	Basic principles and procedures	Techniques
Mobility	Traction Irradiation	Contract/Hold-relax
Stability	Resistance Approximation	Stabilizing reversals Rhythmic reversals …
Controlled mobility /Mobility on Stability	Approximation Normal timing	Combination of Isotonics
Skill	Timing for emphasis	Re-stretch through range Rhythmic Initiation

This ideas are so useful to find the problem or make a hypothesis!

Example: Shoulder problem







limitation of the active ROM of shoulder
less coordination with scapula and upper extremity
less external rotation of Glenohumeral joint
too much side bending of trunk…

How to treat this case in each stage of motor control?

Mobility

Indirect treatment

Hook lying/Bridging

Lower trunk rotation

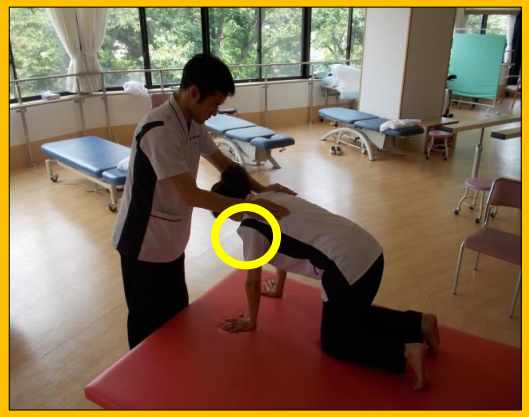
Withdrawal from radial thrust

direct treatment

U/E pattern Hold-relax, contract-relax , Dynamic reversals

Stability

quadraped



sitting

standing

Controlled mobility / Mobility on Stability

quadraped

standing

Skill

Which phase of motor control ?

Which phase of motor control ?

Stages of motor learning

(Fitts&Posner,1967)

Cognitive

What to do in the task/understanding the task

Associative

More “how to do” the task then “what to do” / searching for performance

Autonomous

motor skill mostly automatic, perform the skill in any environment with very little cognitive involvement

Stages of motor learning

Principles of motor learning for PT

Fundumental to motor learning is **practice.**

Motor learning is not a passive imprinting process; it requires **active participation**.

The Law of effect is based on **meaningful goals.**

.

Winstein, CJ 1999

Elements of Motor learning

Practice

Active participation

Meaningful goals

Feedback

Activity/**tasks**

Environment

Task oriented treatment!

Task is able to change the pattern of movement.

What is good?

- More meaningful
- Motivation
- Goal

The task is able to …

Patients need ability of postural control

Control is over tasks, goals or behavior rather than muscles or movement patterns.

The tasks mobilize patient’s reserves!

Task for motor learning!

Age:90 female Stroke :Right hemi on set: March 2014

Goal: live in home by herself independently

Task oriented treatment with PNF concept

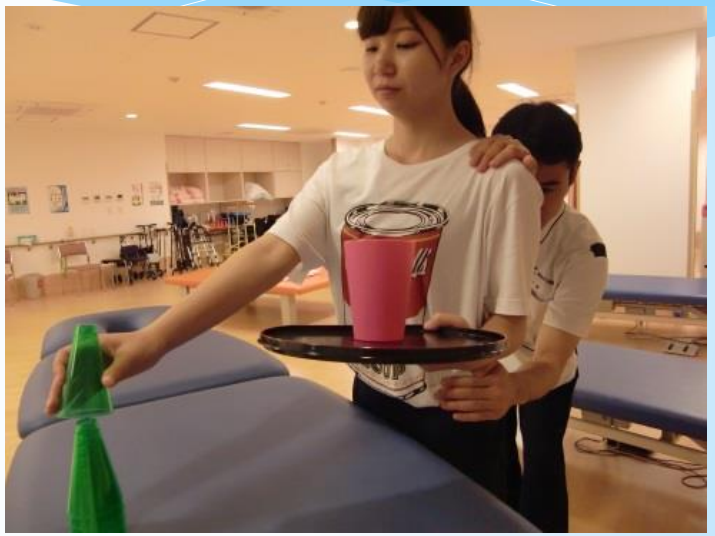
Exercise

Task

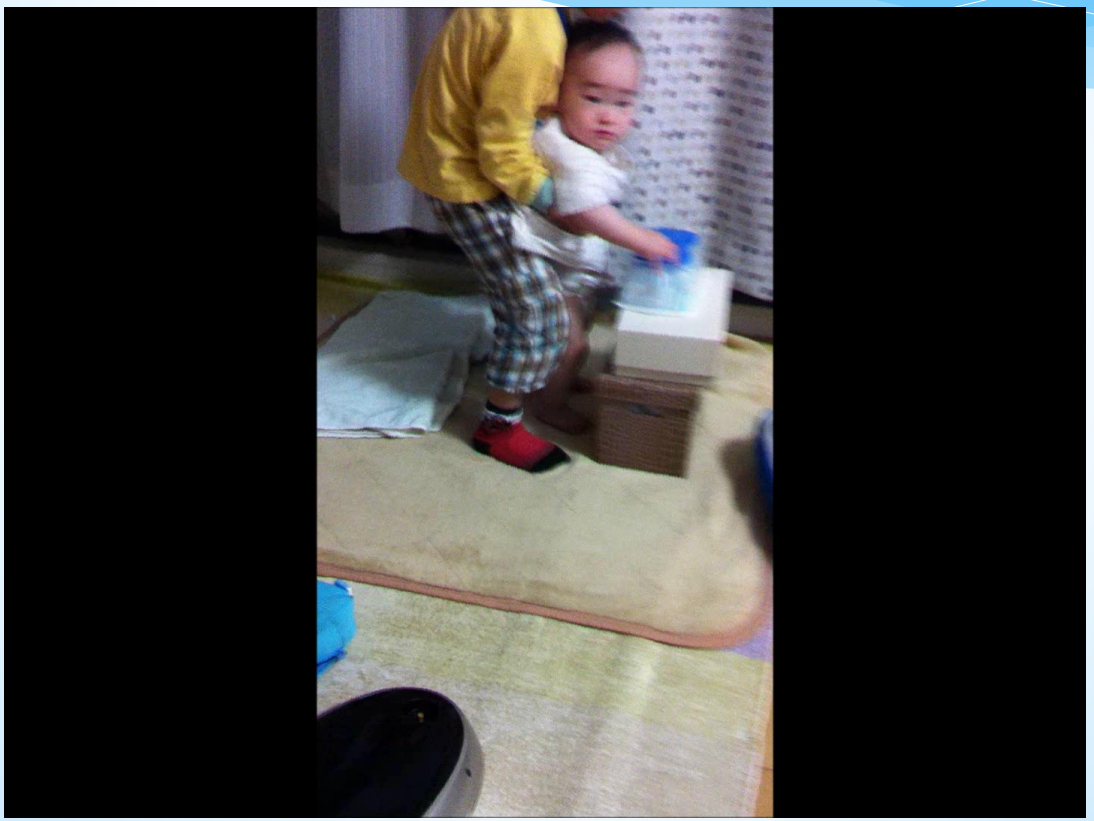
Task + PNF

Task oriented treatment with PNF concept

Task oriented treatment with PNF concept



Task oriented treatment with PNF concept



Summary

- With PNF we can influence all component of movement control

- In PNF approach we use the principles of motor control and motor learning

THANK YOU FOR YOUR ATTENTION!