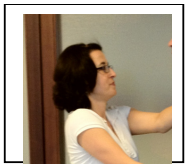
content:

August 2014

Newsletter II IFNFA research committee

In this second edition of the newsletter 2014 we like to present a part of our work on the topic of Motor Learning. The Research Committee set themselves the goal to improve our literature list. We divided the list according to our teaching units, so it is easier to connect publications with parts of the PNF curriculum. One key point in the PNF Philosophy is: the use of motor control and motor learning principles. In this newsletter you will find a short overview as one of the outcomes of the efforts from the committee members.
At the meeting in Greece, all the work, the new literature list and how to use it will be presented. Furthermore the motor learning part will be discussed at the instructor day. We wish you a pleasant reading time, Fred.



From the Research Committee members

In an evidence based practice setting, the therapy should be designed based on supporting literature. The literature concerning motor learning in physical therapy starts with the standard text books on this subject: Shumway- Cook and Woollacott „Motor Control“, Schmitt and Lee “motor control and learning. A behavioural emphasis”. Further literature demonstrates the effects of using specific components and / or learning strategies and principles.

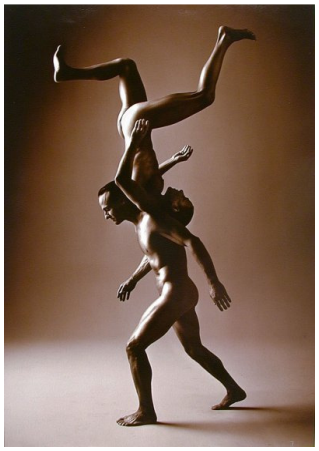
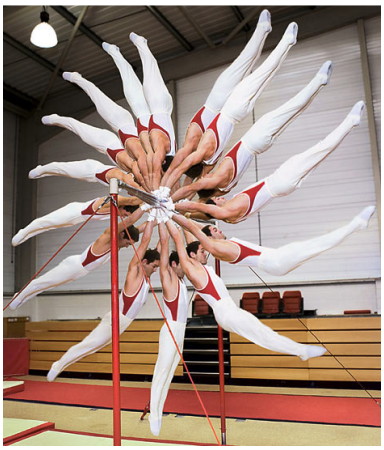
We indentified the following 12 principles within motor learning that should be considered in teaching and using the PNF concept.

1. Emotion, Motivation-meaningful goal for transfer and retention
2. Repetition and Variability in practice
3. Stages of motor learning
4. Shaping
5. Practice conditions
6. Intrinsic vs extrinsic focus of attention
7. Feedback Knowledge of Results / Knowledge of Performance
8. Active participation
9. Rhythmc cueing
10. Cognition as premise for learning / Imagery
11. Action Observation
12. Task oriented Practice

There is a bulk of evidence for various strategies of practising motor learning. Therefore also the choice of strategy should be considered within the context of the treated patient. To be able to make those choices every therapist needs knowledge on the following basics for motor learning:

- Definition: **Learning**, defined as a relatively permanent change, has been distinguished from **performance,** defined as a temporary change in motor behavior seen during practice sessions. This led to the notion, that learning could not be evaluated during practice, but rather during specific retention or transfer tests.
- Forms of learning e.g. explicit / implicit learning; associated and nonassociated learning; procedural learning;
- Learning theories e.g. Adams'closed loop ; Schmidt's Schema theory and Newell's Ecological theory.
- Stages of ML e,g. Fits & Posner; Gentile's Two Stage Model, Systems Three-stage Model (Vereijken, Newell 1992), Dynamic Action Theory / Self organizing Systems Theory (Kelso & Tuller 1984, Jirsa & Kelso 2004)
- Intrinsic versus extrinsic Feedback modus in relation to Knowledge of Results and Knowledge of Performance.
- Structure of practice and their effect on performance versus learning e.g. Guidance, blocked-order, constant exercise, part-task training and massed training are effective in a short-term time mask, but have less retention compared to distributed, variable, random, whole-task, discovery practice conditions.
- Definition of recovery – recovery and compensation (Less stringent definitions define recovery as the ability to achieve task goals using effective and efficient means, but not necessarily those used before the injury. Slavin et al., 1988)
- Factors effecting recovery of function e.g. age, characteristics of the injury, pre-injury factors, post-injury factors (medication etc.)

Kind regards, **Marianne Heidmann and Nicola Fisher.**

Krakauer JW. Motor learning: its relevance to stroke recovery and neurorehabilitation. *Current Opinion in Neurology* 2006, 19:84–90

Purpose of review
Much of neurorehabilitation rests on the assumption that patients can improve with practice. This review will focus on arm movements and address the following questions:

1. *What is motor learning?*
2. *Do patients with hemiparesis have a learning deficit?*
3. *Is recovery after injury a form of motor learning?*
4. *Are approaches based on motor learning principles useful for rehabilitation?*

Recent findings Motor learning can be broken into kinematic and dynamic components. Studies in healthy subjects suggest that retention of motor learning is best accomplished with variable training schedules. Animal models and functional imaging in humans show that the mature brain can undergo plastic changes during both learning and recovery.
Quantitative motor control approaches allow differentiation between compensation and true recovery, although both improve with practice. Several promising new rehabilitation approaches are based on theories of motor learning. These include impairment oriented-training (IOT), constraintinduced movement therapy (CIMT), electromyogram (EMG)-triggered neuromuscular stimulation, robotic interactive therapy and virtual reality (VR).
Summary
Motor learning mechanisms are operative during spontaneous stroke recovery and interact with rehabilitative training. For optimal results, rehabilitation techniques should be geared towards patients' specific motor deficits and possibly combined, for example, CIMT with VR. Two critical questions that should always be asked of a rehabilitation technique are whether gains persist for a significant period after training and whether they generalize to untrained tasks.
Keywords:
hemiparesis, motor control, motor learning, reaching, rehabilitation, stroke recovery

Newell KM, Vaillantgcourt DE. Dimensional change in Motor learning. *Human Movement Science* 2001, (20), 695 - 715

Abstract

Bernstein (The Co-ordination and Regulation of Movements, Pergamon, London, 1967) outlined a theoretical framework for the degrees of freedom problem in motor control that included a 3-stage approach to the reorganization of the peripheral biomechanical degrees of freedom in motor learning and development. We propose that Bernstein's conception of change through the stages of learning is too narrow in its consideration of the degrees of freedom problem and the actual pathways of change evident in motor learning. It is shown that change in both the organization of the mechanical degrees of freedom and the dimension of the attractor dynamic organizing motor output can either increase or decrease, according to the confluence of constraints imposed on action. The central issue determining directional change in dimension is whether the dimensionality of the task relevant intrinsic dynamic needs to be increased or decreased to realize new task demands.

Vereijken B, Whiting HTA, Newell KM, Emmerik van REA. Free(z)ing degrees of freedom in Skill Acquisition *Journal of Motor behavior 1992*, (1), 133 - 142

ABSTRACT. This study reports an empirical investigation into Bernstein's (1967) ideas that in the early stages of the acquisition of a movement skill the coordination problem is reduced by an initial freezing out of degrees of freedom, followed later in the learning process by the release of these degrees of freedom and their incorporation into a dynamic, controllable system. "Freezing" degrees of freedom was made operational both as a rigid fixation of individual degrees of freedom and as the formation of rigid couplings between multiple degrees of freedom. Five subjects practiced slalom-like ski movements on a ski apparatus for 7 consecutive days. Results showed that at the early phases of learning, the joint angles of the lower limbs and torso displayed little movement, as expressed by their standard deviations and ranges of angular motion, whereas joint couplings were high, as shown by the relatively high cross correlations between joint angles. Over practice, angular movement significantly increased in all joint angles of the lower limbs and torso, although the cross correlations decreased. Support for the processes of freezing and releasing degrees of freedom was thus given at both levels of operationalization. In addition, a consistent change from laterally symmetric to laterally asymmetric cross-correlation patterns were observed as a function of practice. Overall, the findings provide empirical support for Bernstein's ideas regarding the mastery of redundant degrees of freedom in the acquisition of coordination.

Key words: asymmetries, coordinative structure, degrees of freedom, directional trends, skill acquisition

Wulf G, Shea C, Lewthwaite R. Motor Learning and Performance: A Review of Influential Factors. *Medical Education* 2010: 44: 75–84

OBJECTIVES Findings from the contemporary psychological and movement science literature that appear to have implications for medical training are reviewed. Specifically, the review focuses on four factors that have been shown to enhance the learning of motor skills: observational practice; the learner's focus of attention; feedback, and self-controlled practice.

OBSERVATIONAL PRACTICE. Observation of others, particularly when it is combined with physical practice, can make important contributions to learning. This includes dyad practice

(i.e. practice in pairs), which is not only cost-effective, but can also enhance learning.
FOCUS OF ATTENTION. Studies examining the role of the performer's focus of attention have consistently demonstrated that instructions inducing an external focus (directed at the movement effect) are more effective than those promoting an internal focus (directed at the performer's body movements). An external focus facilitates automaticity in motor control and promotes movement efficiency.
FEEDBACK. Feedback not only has an informational function, but also has motivational properties that have an important influence on learning. For example, feedback after successful trials and social-comparative (normative) feedback indicating better than average performance have been shown to have a beneficial effect on learning.
SELF-CONTROLLED PRACTICE. Self-controlled practice, including feedback and model demonstrations controlled by the learner, has been found to be more effective than externally controlled practice conditions.
CONCLUSIONS All factors reviewed in this article appear to have both informational and motivational influences on learning. The findings seem to reflect general learning principles and are assumed to have relatively broad applicability. Therefore, the consideration of these factors in designing procedures for medical training has the potential to enhance the effectiveness and efficiency of training.

In Poland there was a conference on PNF in March 2014. The organizers (See Photo below) are planning to organize again in March 2015.

We discovered that we explained the abbreviation PNF wrong in the last decades.
PNF stance for: **Polish Novel Facilitation**.

This attracted a Crowded House. PNF seems to have a big future. *We recommend taking a look at the lyrics of* ***"Into Temptation"*** *from the band Crowded House:* ***You opened up your door, I couldn't believe my luck……***

Irradiation inside the PNF-Concept. A scientific classification.

Abstract and outcome-tables from the master Thesis: Matthias Schulte

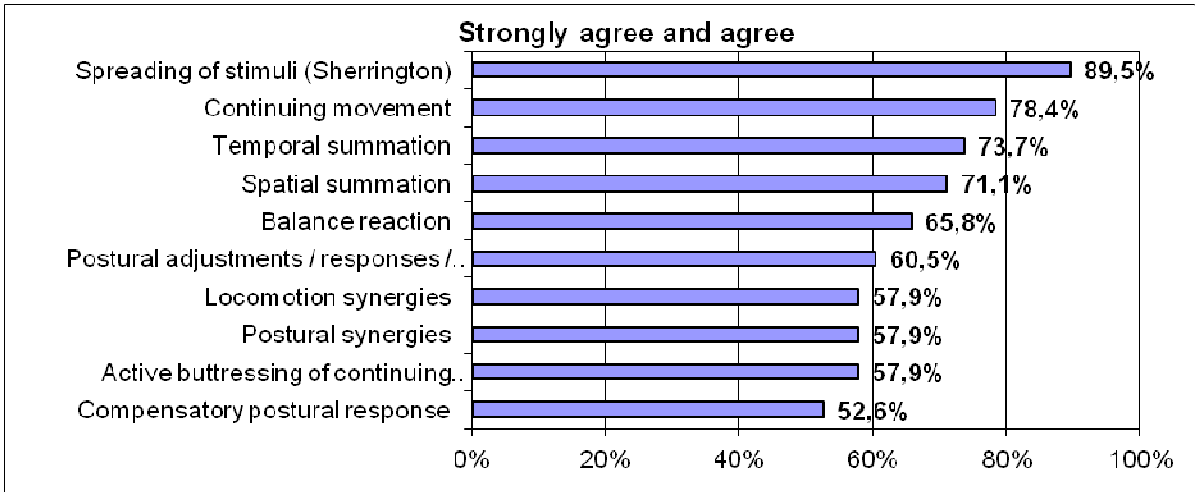
Background: Today the term irradiation is used in its original sense only within the PNF concept. Given the development of other concepts and its scientific use, PNF instructors are again and again approached as to what irradiation actually means now.

Objective: In this paper the term irradiation will be classified in accordance with the current scientific perspective. Terms and phenomena commonly used today will also be examined as to which of these fall under the umbrella notion of irradiation from the perspective of PNF instructors.

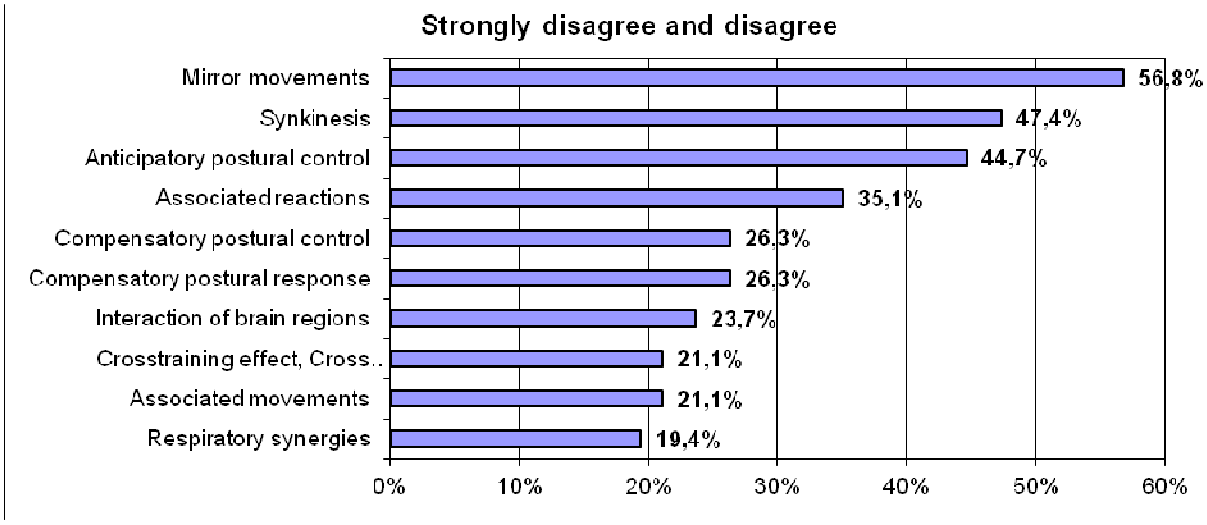
Hypothesis: It will quickly become clear that all of the queried phenomena from the current literature fall under the term irradiation.

Method: During the survey period from 14 March to 14 April 2013, a partially standardized written survey for a sample size of 38, taken from the IPNFA (International PNF Association) of organized PNF instructors, was conducted worldwide and statistically evaluated.

Results: The results can be viewed as representative at a return rate of 45.24%. Of the 20 queried terms and phenomena, ten were considered by more than a 50% majority of PNF instructors to correspond with irradiation. By contrast the maximum rejection of a term at was 56.8%, where however only one term was over 50% (see tables below).



With more than 50% accepted phenomenons.



Distribution of denial

Conclusion: The ten mostly adopted terms represent a basis for discussion over and against representatives of science and other concepts. They can also serve the further development of the PNF concept with regard to a generally recognized evidence-based practice.