

1-The Human Movement System & Our Professional Identity

Rehab Professional as Movement Teacher

Evocation

The map is not the territory. The menu is not the meal. The finger pointing at the moon is not the moon. In other words, we can look at things from different perspectives—conceptually and experientially. Hiking the trail is a different experience than reading the map. Reading a menu is not the same as tasting the dish. Fixing a car is different from driving it. Similarly, memorizing anatomical facts is not the same as *understanding movement*.

Dissecting cadavers and teasing out the exact directions of the muscle fibers or tendinous inter-digitations is not the same as observing and analyzing muscular synergy patterns and regional skeletal interrelationships in a living/breathing/moving person. Additionally, prescribing exercise is not the same thing as *teaching movement skills*. Exercise for the purpose of building sarcomeres, improving cardio-vascular fitness or affecting connective tissue properties is fundamentally different from an exercise that seeks to teach functionally relevant movement, appropriate body mechanics, arthrokinematic control and correct posture—*exercise for motor control* purposes needs to be approached differently than exercise for physiological purposes.

Finally, TV commentators and basketball players have very different ways of looking at the game. Being able to *do/feel/appraise movement* in your own body gives you a different viewpoint on how bodies work—and how bodies work optimally. An experiential perspective changes the way you look at others when analyzing posture, assessing movement and administering tests. Opening a window on these differences, advocating for a more dynamic vision of human movement, encouraging rehab professionals to take a more personal interest in movement, and suggesting a shift from exercise-centric to movement-centric rehab thinking—this is the purpose of this program.

Theories about how *movement is organized* don't help much in figuring out how to *organize a movement*. One is general and mental. The other is personal and sensory. One contains background information—the airplane pilot has a basic understanding of aerodynamics and propulsion. The other contains specific information—the pilot has learned to exert manual control over stick, throttle and rudder.

**“We are not
stuff that
abides, but
patterns that
perpetuate.”
Norbert Weiner**

This multi-media program, which is liberally sprinkled with movement videos and a couple of personal movement mini-labs, provides a short peek into this rich, juicy and fascinating topic. This book may provoke casual interest or visceral resistance. It may elicit gasps of astonishment or groans of dismay as our cherished exercise, evaluation and manual therapy models are scrutinized. Or, it might fire your enthusiasm to learn more and delve deeper into a subject that is, or should be, near and dear to our hearts as rehab professionals.

My hope is that this book will pique your curiosity, that it will redirect your thought processes into a wider and more inclusive vision of functional movement, and that it will help you to better assist your patients in *their* understanding of, control over, and comfort in their own bodies. This book is about the nuts and bolts of integrated movement, or how the various parts of the body cooperate with and support each other in a coordinated state of mutual benefit—or not. It will be asking you look past the exercise to see the movement, to look past the parts and *see the patterns*.

The Whole is More Than the Sum of Its Parts

This is not intended to be a scientific treatise and, though there will be a fair amount of bibliography, I have no expectations that this will ‘prove’ anything in the classic sense. More editorial and paradigm-nudging than double-blind study, this book is concerned with human movement from a rehabilitation perspective and is clinically based. How do real life people move and how can we as rehab professionals get them to move better?

To provide some perspective on where this content comes from, some brief background. I am a physical therapist, trained in the early 80s in what we might call a traditional or conventional way. As a kid growing up, I was always interested in movement and was fairly proficient at games, sports and martial arts. I went to physical therapy school because I wanted to learn more about movement, so off I went.



In PT school, I learned the building blocks of movement—musculoskeletal anatomy and neuroanatomy. I learned the tools of our trade—ultrasound, electrical stimulation, whirlpools, crutches, canes, walkers, heat/cold, traction machines, wheelchairs, weight and our trusty thera-band. I learned great techniques—joint mobilization, PNF, muscle energy, strain/counter-strain, taping and myofascial release. What I didn’t learn about was movement!

Why do people move so differently? How are movement and postural habits formed? What are the strategies I can use to teach complex movement skills? No discussion. What am I looking for in inter-relational movement dysfunctions and is there a way to correlate them to my patients’ presenting complaint? How do I analyze a movement for relevant muscle synergies—or identify poorly balanced antagonist pairs? Crickets. I learned all sorts of ways to *influence the elements* of movement—muscle flexibility and strength, joint capsule or fascial plane mobility, and so on.

But for me, once I finished school and started working out in the fields, they were ad hoc solutions, rule of thumb techniques that sometimes worked and sometimes failed. I realized that there was no unifying movement theme in our profession—no codification of what ‘good’ movement is and no vision detailing how it is most effectively taught. I realized that collecting the ingredients, influencing the parts, was not the same as baking the cake or *coordinating the whole*. With movement training unavailable in school and rehab-related con ed, I needed to look outside our profession for answers.

It was five years after graduation from PT school that I first experienced a style of movement training that we will be calling **dynamic integrated movement**. It was fundamentally different from what I had learned, both in the movements themselves, in how the movements were taught and learned, and in terms of positive effect. Rather than localizing and isolating, rather than focusing on stretching and strengthening of individual muscles, they emphasized quality of coordination, or whole-body movement, and proprioceptive awareness.

I was hooked. I trained in this style and in a few other dynamic integrated movement systems over the subsequent thirty years. Happily, I have survived the journey, and have returned from the other side, unscathed and bearing gifts. Unscathed in that in all my wanders, through all the movement training, I retained my original loyalty to and identification with PT and medical based rehabilitation. I looked at the movements learned in these systems through the lens of the following rehab-related questions:

- What are the relationships of all these different bones to each other? Is there a *pattern to be recognized*?

- What is the *muscular breakdown/synergist analysis*? Which muscles are worked and which lengthened?
- For whom could this pattern of movement be useful? Which of my patients *would I use this with and why*? And for whom would they be *contraindicated*?
- What real-life functional activity does this pattern of movement resemble. How would I use this movement to teach an *improved real-life skill*?

Bearing gifts in that they are an absolute gold mine of rehab-useful exercises and facilitation techniques. I have had to change them a bit, to modify them to fit more easily into a rehab environment. I had to disregard some of their language pertaining to their systems and come up with a more rehab-friendly language that medically articulated what this style of exercise can do for us and why.

“The breaking of a wave cannot explain the whole sea.” Vladimir Nabokov

I had to blend what I had learned in these systems with what I had previously learned through PT means—joint mobilization, myofascial techniques, evaluation and pathology paradigms and so on. In an integrated body, all the layers of an onion mirror

each other and are related to each other—skeleton (bone/cartilage), joint (ligaments/capsule), fascia (muscular, visceral and nervous system), muscle (tendons/contractile properties) and brain (motor, sensory, emotional and intentional consciousness) all interact in ways either beneficial or detrimental to the organism.

Notice that we have several more or less passive structures (bone, joint, ligament, capsule, fascia), along with the active but dumb structures (muscles). We in ortho rehab have been focusing our clinical efforts mostly toward influencing these lower level elements—joint mobilization, myofascial techniques, muscle strengthening and stretching. What we haven’t yet fully developed in our work is the ability to more optimally affect the controller of this whole system—the conductor, the maestro—the brain and the rest of the central nervous system.

There is an old story told about six blind men and an elephant. Because none of the blind men knew what an elephant looked like, they had to discover the properties of the elephant by touch. One blind man touched the tail and declared that an elephant is like a rope or liana. Another touched a leg and likened an elephant to a tree trunk or a pillar. Yet another touched its’ side and said that an elephant was like a wall.



A fourth touched the ear and noted its similarity to a large fan, the fifth felt the trunk and decided it was a species of large snake, while the last man ran his hand along the tusk and proclaimed the elephant a bark-less tree branch. These are all elements of the whole, but provide an incomplete or even misleading picture of that whole. You will also notice that the blind men likened their vision of the elephant to something inert or something that lacks full consciousness. They must have missed the *function of the brain* as organizer too, perhaps because it is the one thing that can’t be directly touched or measured—it has to be ‘seen’ or grasped in its entirety.

Following this thread, one perspective when working with the human musculoskeletal system, and an invaluable one, is conceptual and is concerned with the function of the parts that make up this system. Detailed study of cadavers or surgical anatomy, tissue stress tests on lab animals or EMG/diagnostic ultrasound studies are modes of inquiry. Findings include connective tissue tensile strength, healing mechanisms, muscle activation timing and recovery times for various tissue injuries/surgeries.

Concepts that inform our understanding include force couple biomechanics, length/tension relationships, force vector and moment arm analysis. We now know about muscle fiber types, cartilage properties and arthrokinematic slide/glide/roll. We have developed sophisticated evaluation techniques that anatomically stress suspected tissues—crank test, Hawkins, scour, pivot-shift and anterior drawer. We have established scientific and tissue based guidelines for manual therapy techniques, low load prolonged stretch or progressive resistance strength training of individual muscles.

This is a detailed or ‘small picture’ angle and is all good stuff—and is only accessible through a conceptual or observational perspective, not an experiential or subjective one. If my shoulder hurts, I can’t tell if it is a rotator cuff impingement or a SLAP tear. I can’t tell by feel when my patellar tendon has healed sufficiently after rupture and repair to stress it. This knowledge helps to inform our clinical decision-making, but this knowledge is far from the whole picture.



Fortunately, there is another perspective that can contribute to our knowledge base. It is the perspective of the one who observes the elephant in motion. The one who sees how legs, trunk, ears and tusks work together to move, to coordinate and serve the organism—who sees the conductor behind the orchestra—the driver in the race car—the entity that organizes and directs everything. This frame of reference is not entirely visual, but draws on proprioceptively-obtained information and pattern-recognition skills. This is a relational or ‘big picture’ angle and can’t be gained through detailed examination of parts. This program is an invitation for you as a clinician, and for us as in the rehab professions, to look at the marvelous complexity of the human musculoskeletal system with fresh eyes—it is a guided tour of the big picture.

Stepping away from the anatomy lab, getting out in the field and appreciating how the disparate parts interact in a real-life and moving body is the focus of this book. We shouldn’t forget what we learned about anatomy, but we need to realize that anatomy is not movement. We can still use these great treatment techniques that we have either borrowed from various sources or have developed on our own, but we need to keep in mind that all these techniques are in service of a bigger theme—optimization of human movement. Continue to see and treat the parts, but expand your vision to include the optimal *interrelationships of the parts with the whole*, as well as the *neural aspect that controls* these interrelationships.

Our Very Reason for Existence

In 2013, the American Physical Therapy Association adopted a new vision statement (1), one that was intended to guide our profession for twenty years: **“Transforming society by optimizing movement to improve the human experience.”** While transforming society seems a somewhat lofty, though worthy goal, my attention as a movement geek was drawn to the optimizing movement part. This vision statement suggests that our role in the health care industry is one of movement experts and movement teachers.

Shirley Sahrmann, one of the leading luminaries of our profession, wrote an article making this very point (2). To borrow from and expand upon the abstract: “...there is growing evidence, particularly in relation to musculoskeletal

conditions, that the focus is enlarging from pathoanatomy to pathokinesiology, further emphasizing the timeliness of promoting the role of movement as a system.” In other words, our old pathoanatomical paradigm of identifying and treating the *tissue at fault* (bad anatomy) needs to make room for a more expansive paradigm that recognizes the connection between musculoskeletal health and movement quality—one aspect of this is pathokinesiology (bad movement). In other words, our goals need to go beyond just restoring full mobility and strength to an injured part.

We should also be identifying and rectifying the deterioration of movement quality that happens as a result of injury—movement training needs to be part of *treating traumatic injuries*. The abstract goes on to say, “...discussion also addresses musculoskeletal conditions as lifestyle issues in the same way that general health has been demonstrated to be clearly related to lifestyle. The suggestion is made that the profession should be addressing kinesio-pathologic conditions and not just pathokinesiology conditions, as would be in keeping with the physical therapist’s role in prevention and as a life-span practitioner.”

To rephrase, part of this new paradigm focuses on addressing conditions where pathology (neurological insult or musculoskeletal trauma) negatively effects movement—pathokinesiology. But we also need to expand our paradigm to more fully address conditions featuring suboptimal postural or movement habits that *lead to pathology*. She is suggesting that we identify the *patterns at fault* that often lead to tissue distress and eventual breakdown—this is kinesio-pathology (poor movement quality creating pathology). Movement training is then a key requirement in *managing repetitive stress injuries*, degenerative conditions, spinal hypermobilities and other self-inflicted musculoskeletal misery (all of which dwarf traumatic injuries in pain suffered and medical assistance sought).

“No idea is so antiquated that it was not once modern. No idea is so modern that it will not someday be antiquated.” Ellen Glasgow

Having come out of PT school in 1983 and being interested in ortho/spine/sport, I thought primarily in terms of the mechanics of the body. I mobilized joints to improve joint play and arthrokinematics. I utilized tissue release techniques to improve fascial mobility and range of motion. I prescribed exercises to stretch or strengthen individual muscles. I was a mechanic, twiddling the nuts and tightening belts. I assumed coordination of the parts through improvement of the parts. But I was just thinking, and practicing, in the way I was taught—in the way we all have been taught.

We in the ortho field have been lead to believe (implicitly, unconsciously, unintentionally) that bodies are machines, and that they can be understood mechanically and ‘fixed’ within a mechanical framework of understanding. What we generally haven’t been taught are the tools to complement our mechanical skills as ‘fixers’ with the movement facilitation skills as ‘teachers’. Figure that for each joint that is mobilized, for each fascial plane that is released, for each muscle that is strengthened, there needs to be a corresponding change in *neuro-motor behavior*.

If you utilize a technique that increases range of motion in a joint, you need to follow up by both training the relevant muscles involved to move into that new range and re-utilizing that new range in daily activities. The nervous system needs to be re-programmed to assimilate and functionalize the new movement possibilities you have created and to reunite the targeted muscle(s) with its’ synergists.

There are particular strategies for doing this, and they will be systematically introduced throughout. But as a preliminary, there are a couple movement-related clinical tools we may want to add to or update in our toolbox. If we as a profession are to adopt this role of movement teacher and to grow in clinical movement mastery, there are a couple of important questions to answer.

Questions to Answer

What is optimal and suboptimal movement? How can we define or codify it specifically rather than generally? This question encompasses more than objective criteria. Manual muscle testing and goniometric measurements are not enough, as the function of parts is not a guarantor of efficient coordination of the whole. Though range of motion and individual muscle strength is an aspect of optimization, objective measurements alone cannot define it.

What happens to movement quality after traumatic musculoskeletal injury? Can we foresee not only the inevitable stiffness, instability or weakness around the injured part, but recognize how the rest of the body reacts to the loss of function of that part or the pain produced by that injured part? Avoidance and substitution patterns will manifest locally, regionally and globally. We should be able to anticipate these changes in movement organization and quality throughout the whole body and take these distal and sometimes hidden effects into account as we design our exercise progressions.

How do suboptimal movement or postural biases predispose us to certain types of sudden or traumatic injuries? This question relates to our straw-that-broke-the-camel's-back injuries. Someone with life-long short hamstrings bends over to pick up the soap in the shower and blows out a disc. Someone with a stiff and kyphotic thoracic spine gets rear-ended at 10 MPH and suffers from whiplash. These are perfect storm injuries. A person already moves too much or works too much in one area, then gets whacked in the same place and in the same direction, sometimes even by a seemingly innocuous event.



We need to account for the fact that this person's preexisting movement and postural habits made them more susceptible to the injury. We also need to realize that these habitual patterns continue unrecognized and unabated after the injury, unintentionally continuing to create and reinforce the same types of movement stresses as the mechanism of injury. This will obviously complicate any path to recovery from that kind of injury.

How do suboptimal movement or postural biases create repetitive stress injuries? This is a huge part of our practice. The second leading cause for doctor visits in the US are chronic, recurring or degenerative joint, tendinous or myofascial conditions—closely followed by low back pain in third place (3). Repetitive stress or self-inflicted injuries are epidemic. From cervical disc to plantar fasciitis, from ankle impingements to anterior knee pain and from low back pain to tennis elbow, these types of life-style related injuries swamp traumatic injuries in numbers of afflicted, in suffering produced and in catastrophic losses for insurance companies.

Just treating these types of injuries locally is inadequate/incomplete. Treating exclusively local tissues with various modalities, stretching and strengthening local muscles or mobilizing site-of-injury joints is under-serving our clients. We need to see the forest through the trees. We need to be able to see/understand how movement dysfunction in one place contributes to repetitive stress injury somewhere else. We need to have a solid

“Sometimes when you innovate, you make mistakes. It is best to admit them quickly, and get on with improving your other innovations” Steve Jobs

understanding of how the body works so we can identify suboptimal body interrelationships and address those interrelationships with our manual interventions and movement training/exercise prescriptions.

How can we get our patients to recognize their suboptimal movement pattern? What strategies or techniques can we use to facilitate patient proprioceptive awareness of what makes a particular movement or postural pattern more optimal? Whether chicken or egg, whether suboptimal movement is *causing* injury or is *resulting* from injury, our patients will need some proprioceptive self-awareness training. Moshe Feldenkrais had a famous saying: “If you know what you’re doing you can do what you want.” Sadly, people generally don’t know what they are doing—they are in a proprioceptive fog. They continue to repeat the same suboptimal patterns, hoping to get different results.



A large part of our job is then to help people to be more aware of what they are doing, how the way they are doing things contributes to their musculoskeletal misery or delays their recovery from injury, and to present options that are demonstrably better in subjective terms of comfort, efficiency or preference.

How can we get our patients to move differently, more optimally, when the habit driven nervous system keeps dragging them back to homeostasis and when entropy devolves them to least common denominator? This question concerns creating new, more optimal movement and postural habits. The way the nervous system works, the way neurons ‘fire and wire’ together, keeps bringing these movement and postural patterns back to what is familiar. To a certain extent, we are fighting an uphill battle when asking the habit-driven nervous system to make a change. Most people, again, have no idea what they are doing with their body—most of us just go on auto-pilot.

People make changes in their movement and postural patterns not because we, as experts, tell them to. This is cortex-deep knowledge only and they will forget. They make changes not because a double-blind study says so. They couldn’t care less about what the journals say. They make changes because they have:

- *Recognized* the error of their ways—the way they do something contributes to their pain, loss of function or full/speedy recovery from injury.
- *Explored* proprioceptively and experientially other options that we, as movement experts, have provided—they need to open up the hood and get their hands dirty.
- *Recognized* these other options or solutions to their movement puzzle as feeling better, more efficient—they have arrived at a preference and have made an informed decision based on comparison of options.
- *Practiced* these new movement patterns in a variety of positions and related to a number of different functional contexts—they have developed the skill of pattern recognition or pattern reproducibility and have created a new ‘muscle memory’.
- *Adopted* these new habits/movement patterns, learned during our prescribed informational exercise, to daily activities—they have recognized the pattern, acknowledged its’ benefits and extrapolated it to life!

“Experience is what enables you to recognize a mistake when you make it again.”

Paul Wilson

Benjamin Franklin, the famous American inventor and quote-guru, said: “Tell me and I forget, show me and I remember, engage me and I learn.” We need to engage our patients in a *progressive learning experience*, individually tailored to their particular needs and paced according to their ability to assimilate the information. We

should aspire to be that map and compass that leads our patients out of the bewildering wilderness of pain and dysfunction, realizing our invaluable contribution to their recovery, but also acknowledging to ourselves that we cannot just fix them—they are *not* just machines.

They are the ones that have the primary responsibility for paying attention to, and initiating corrective action in, their own bodies—we have the responsibility of teaching them how to do that. And, while we can show them the map, they need to walk the path for themselves—with their proprioceptive ‘eyes’ wide open.

Boiled Down

In summary, we should be movement teachers or optimal movement facilitators with two primary areas of focus—***what do I want to teach and how do I want to teach it?*** In this next chapter, and in subsequent chapters through the rest of the book, we will be attempting to answer these questions. This next chapter is an introduction to integrated movement, which suggests a study of the coordination among the parts, not just movements of the parts themselves. This is not historically how we have understood movement or have applied treatment techniques, especially exercise.

Hammer in hand, we naturally hunt for nails. If we define a problem as weak muscles, the solution is then to strengthen them. If we define a problem as tight fascia, the solution is to stretch them or do some release technique. If we define a problem as mal-aligned vertebrae or joint capsule restriction, the solution is to mobilize them. But if we define the elephant as a big snake or a tree trunk, we are missing a bigger picture.

“If all you have is a hammer, everything looks like a nail.”
Bernard Baruch

We have had an historic/collective tendency to treat the parts and hope for improvement of the whole. This is in large part because of our fundamental misunderstanding of human movement. We haven’t yet fully grasped the fact that bodies are *integrated*. Consequently, we have not yet widely implemented integrated movement and integrative exercise principles into our professions. This is not an indictment and no charges will be filed, but we certainly can be educating ourselves more in this direction.



1. Apta.org
2. [The human movement system: our professional identity.](#)
Sahrmann SA Phys Ther. 2014 Jul;94(7):1034-42.
3. [Mayo Clinic-www.advisory.com/Daily-Briefing/2013/01/22/Study-IDs-the...](http://www.advisory.com/Daily-Briefing/2013/01/22/Study-IDs-the...)

2-Acknowledging Movement as Integrated *Evidence & What Happens If?*

Historic Influences on Movement Training & Exercise

In our species' far distant past, movement was for the most part intuitive and focused on outcome—throwing spears, dancing around bonfires, running from leopards and so on. Movement was experiential and personal—how do I learn it or how can I make it better were primary concerns. With the advent of the age of reason and the industrial revolution, we started probing the mysteries of the movement body. We started breaking things into components and figuring out what each individual part does.

Bones, joints, ligaments, fascial planes and muscles were all identified and labeled. Muscle function was assumed and rationalized through cadaveric examination and, through a process of reverse engineering, exercises were designed to stretch and strengthen these muscles. Isolate and localize exercise was developed in the late 19th and early 20th centuries and later adopted by the fledgling rehab professions.

To integrate means to make entire, whole or complete—this word was not in the dictionary when I came out of PT school. When I was learning my craft back in the early 80s, *therapeutic exercise* was king and Kendall & Kendall's Manual Muscle Testing was my venerated template of rehab exercise. Isolate and localize was my mantra, and I didn't know that bodies are integrated. When I used to do biceps curls with someone, I was strengthening the biceps—end of story.

**“Isolation is the sum total of wretchedness to a man.”
 Thomas Carlyle**

When I did straight leg raises, it strengthened the quads and hip flexors—no need to look any further. Side lie gleno-humeral external rotation with a 10# dumbbell strengthened the infraspinatus/teres minor—what do the abdominal obliques or hips have to do with it? Grasping the ankle and pulling heel to hip stretched the quad—who cares what the low back does as long as you can feel that quad stretch?

It was easy. Easy for me to teach and easy for my patients to do. It was simple. Simple to observe and simple to document. It was convenient. Patient supervision could be casual or absent, and there were all these cool exercise flash cards commercially available that made my life easier. The only problem? It was inaccurate—undeniably false.

My belief in strictly isolated movement and isolated muscle use, as well as my faith in classic therapeutic exercise, was misplaced. Yet amazingly, people still made improvement. How did this happen if the thought process behind my exercise was invalid? To answer this question, we need to look in another direction. We need to look beyond localize/isolate thinking and *assumed stability* to interrelational thinking and *trained stability*.

Joseph Pilates can perhaps be credited with this next evolutionary leap. He explicitly articulated or implicitly embodied in his exercise system three main principles of movement that have since migrated to the rehab world: **a. bodies are integrated** and there are specific relationships between the limbs and the torso/pelvis, **b. musculo-skeletal pain and dysfunction can result from things moving too much**, and **c. there needs to be an element of awareness or attention to quality** to make the movements specific/accurate.

Relationships of limbs to trunk. When doing a biceps curl, we now know that the engagement of the biceps and the weight of the forearm will drag the shoulder girdle into anterior tilt by virtue of its attachment to the scapula. This is a suboptimal organization when doing a curl or lifting a big box of groceries. The scapula needs to be stabilized

(prevented from moving) as the biceps contracts. Scapular and arm muscles work synergistically, or as an integrated team.

When lifting a leg while supine, the hip flexors and the weight of the leg will drag the pelvis into anterior tilt and the low back into extension. This for most people is suboptimal, and the pelvis should be stabilized (prevented from moving) when the hip flexors contract. Trunk and hip muscles work synergistically. We know this, and have thus (sometimes to mostly) evolved from oblivious or assumed stability (unconscious to relationships and identification with individual muscle strengthening) to trained stability (conscious awareness of relationships and identification with training groups of muscle synergists).



Check out this first video to get a visual representation of the reading. In this video, we are going to play several games of “*what happens if...*” What happens if I lift my leg, raise my arm, lift my head—without stabilizing proximally? What would happen if the muscles that move my limbs are *not* coordinated with the muscles that stabilize my pelvis, trunk or scapulae. To ask it another way, what am I stabilizing against? What would happen if I *didn't* stabilize or if a muscle did just work in isolation?

This is a foundational skill for movement teachers. During the subsequent video, see if you know or can guess the answer to each ‘what happens if’ questions. No need to keep score. Please keep in mind that this isn’t Hollywood and we’re not professional actors—please value content over presentation. Don’t worry if this doesn’t make perfect sense, if this is a strange way of thinking about things for you, or if you can’t see where this is going yet—it will be clear by the end of the program.

◀Please Pause Here to Watch Video 2.1 (8:30 minutes)▶

So how did you do? Were you familiar with the proximal movement or instability effect in each of the scenarios? This what-happens-if skill is an important one for a movement teacher. Knowledge of what to do with that information comes next. The next question we need to ask is—what would I *like* to have happen instead? What would be *better* than allowing the proximal instability shown? Then, what muscles need to be coordinated, what muscle synergy patterns need to be trained, so that *optimal* proximal control is maintained? You probably have an answer, but you might be surprised to know that there is more than one answer, more than one option—we have choices in how we think to regulate or control these interrelationships (static or dynamic).

Musculoskeletal pain can result from too much movement. In the 80s, we stretched everything related to the affected part, commonly doing this in all directions to cover all our bases in a classic shotgun approach. We imagined that everything that was hurting was too stiff and needed to be stretched. We now know that a vast array of self-inflicted wounds can manifest as a result of moving too much (hypermobility) or working too hard (hypertonicity)—plantar fasciitis, hip labral tears, low back and neck degenerative conditions and gleno-humeral anterior instabilities are just a few examples. These are conditions that don’t fit our old paradigm of stretching the affected tissues in all directions and hoping for the best.

Importance of accuracy and attention to detail. Therapeutic exercise assumes (or hopes) that the exercise will spontaneously change behavior. Just put in the reps and progressively load more weight and that weak muscle will joyfully come to its senses and leap back to the work for which it was hired. Credit Joseph Pilates (and many others) with pointing out the need for movement self-awareness and specificity not only during exercise, but out in the real world as well. Making qualitative changes in movement accelerates when you to pay attention and when you emphasize accuracy, specificity and quality.

“We are what we repeatedly do. Excellence, then, is not an act, but a habit.” Aristotle

Paradigm Shifts & Exercise Inspirations

So how did improvement happen in the good ‘ole days when we thought we were doing isolate and localize exercise? Probably because many people (but not all) were *unconsciously stabilizing* in the presence of a what-happens-if situation—trunk, pelvic or scapular perturbation. Some aspect of their consciousness was paying attention, even while inwardly agonizing over what wine to serve with dinner that night. But the truth is, there never was such a thing as isolate and localize. We simply assumed stability.

We took for granted that something would move relative to something else that automatically wouldn’t move because of the way we learned anatomy (origin and insertion—where the proximal/immobile bone provides a base for the distal/mobile bone). The fact that bodies move as an integrated entity was there to be seen, but we didn’t see it. We didn’t think to ask ‘what happens if’. Maybe we thought it was too complex—thinking in terms of isolated movement was easier. Or maybe we thought our patients were too dense to learn complex motor skills—better stick to the basics.

But now we know that bodies *are* integrated. And not only are they integrated, they are also messy, unpredictable and complex. It’s easier to see the parts, but harder to see the relationships. It’s easier to improve the parts—it’s much more difficult to affect a positive change in whole-body organization or to optimize motor planning. But that is the task we have before us. Integrating or coordinating exercise *is* harder to wrap your head around and harder to teach than localizing and isolating exercise, but one approach is reality and one is illusion. Probably, we just weren’t looking for these integrated relationships because we just hadn’t considered the possibility—we weren’t looking in that direction.



In what direction should we have looked? Where should we have made our observations about how bodies are (best) coordinated/integrated? Where should we have sought inspiration about rehab-related movement and optimal movement principles? To living, moving human beings who *move well*—children at various stages of the developmental sequence, dancers, athletes, martial artists, yogis. All intricate and detailed movement practices that provide a treasure trove of potential rehab content.

Where did we look instead? Where did we get our inspiration, our template for understanding the glorious complexity of human movement? It used to be the cadaver lab—which provided us good intel on parts but left us in the dark about movement coordination and optimization. But those days of localize and isolate thinking about exercise are (slowly) passing, and something else is taking its' place. Assumed stability is fading and trained stability is ascendant—with Joseph Pilates as a charter member of the brain trust.

Now, instead of developing rehabilitation related exercise based just on anatomy labs and cadaveric minutia, we base it on flu patients in hospital beds. This was Joseph Pilates' inspiration for the core stabilization exercises and movement philosophy that so influences our professions today. At least we are heading in the right direction. But while as a fitness exercise it marvelously tones and sculpts, it is not an adequate *rehabilitation model* for many/most of the things we want to do.

Perhaps jarringly, I am suggesting we move beyond this way of understanding movement too. There is another way, a better way of understanding integrated movement, prescribing integrative exercise and training movement optimization. Another level of understanding—past old assumed stability thinking and past current trained stability thinking to movement training paradigms based on dynamic optimization principles and on very different assumptions about how the body actually works. More on this in the Static/Dynamic Integration chapter.

And so continue using therapeutic exercise for *physiological purposes* as needed—fibroblast stimulation, collagen fiber alignment, sarcomere enlargement, joint range of motion and so on. But realize that localize and isolate ideas (assumed stability) are slowly headed for the dust bin of history, as they are clearly not a reasonable response to the question of 'what happens if'. Also realize that we don't just prescribe exercise for physiological purposes—we also do exercise for *motor control purposes*.

Motor control purpose entails everything from postural improvement (the way we sit, stand, sleep) to ergonomics and body mechanics instructions (the way we bend, lift, walk, reach, climb stairs or get out of the bathtub), and to arthrokinematic control (patellar tracking, centering head of humerus in the glenoid, spinal intersegmental stability). These are inter-relational or coordination issues, not parts issues—they require (qualitative) integrative exercise, not (quantitative) isolate/localize exercise.

And, we are making improvement in this regard. Our professions have (mostly) moved up a rung from our old isolate and localize paradigm and have, for the last few decades, embraced a *static integration* view of human movement. This is a big step in the right direction, but we haven't reached the top of the ladder yet. We have at least one more step to take—one that is distinctly different from static stability-based understanding. This next step in our level of understanding, along with a proposed exercise genre derived from these sources, is what we could call a *dynamic integration* view of human movement.

But before we dive into the comparative merits of each of the two competing integrated movement systems that we *can* use for motor control purposes, let's see if there is anything to be said about movement inter-relationships in the literature.

Regional Interdependence

Regional Interdependence (RI) is a term used to denote distal influences on a local problem. For our purposes, RI is essentially interchangeable with integration. There are a couple of nice overview articles on this subject, with a plethora of specific studies cited to back up the idea/concept. Sueki, Cleland and Wainner wrote a very nice 2013 summary article in the *Journal of Manual and Manipulative Therapy* titled "[A regional interdependence model of musculoskeletal dysfunction: research, mechanisms, and clinical implications.](#)" (1)

In it they defined regional interdependence as: “A practice model that uses the underlying premise that seemingly unrelated impairments in remote anatomical regions of the body may contribute to and be associated with a patient’s primary report of symptoms.” They go on to state that: “The clinical implication of this premise is that interventions directed at one region of the body will often have effects at remote and seeming unrelated areas.”

Paraphrasing, this is connected to that and limitation or dysfunction distally can have a negative local effect—by addressing that distal limitation or dysfunction, we can have a positive effect on the presenting complaint. We already know this intuitively or through collective lore. If we lack ankle dorsi-flexion, we can get excessive foot pronation. If we lack hip extension, it may be compensated for with lumbar hyper-extension. If we are limited in thoracic rotation, the neck needs to twist more. If thoracic extension and posterior scapular tilt is compromised, the shoulder joint may be moved too much—contributing to gleno-humeral impingement.

“Relationships are all there is. Everything in the universe only exists because it is in relationship to everything else. Nothing exists in isolation.” Margaret J. Wheatley

Vladimir Janda, a Czech physiatrist and leading voice for integrated movement optimization in our profession, said: “The system functions as an entity. It is principally a wrong approach to try and understand impairments of different parts of the motor system separately without understanding the function of the motor system as a whole.”

Shirley Sahrmann is another voice urging a regional interdependence approach to musculoskeletal issues. In her book Diagnoses and Treatment of Movement Impairment Syndromes (2), she described the phenomenon of *relative flexibility*. This states that “stiffness in one muscle group or joint will cause compensatory movement at adjoining (or distal) joints that are controlled by muscles and soft tissues that exhibit less stiffness.” The body will follow what Ms. Sahrmann calls the path of least resistance. Once that path of least resistance is habituated and repeated many times, the tissues along that path of least resistance become even less resistant, often times to the point of hypermobility.



At the same time, the path of *most* resistance gets even more resistant as movement stresses are absent and adaptive shortening/stiffening take place. This creates a death spiral where one place gets looser/more hypermobile as a related area becomes stiffer/more hypomobile. Logically then, we would put our focus on stretching/mobilizing the hypomobile part to reduce hypermobility stresses and resultant tissue breakdown at the too-loose site.

However, because the habit-driven nervous system already has the path of least resistance well worn, movement will tend to continue along the old path even after the hypomobile area has been liberated by exercise, myofascial technique or joint mobilization. The nervous system is *sensorially habituated* to the old pattern, and this ‘desire’ to

match the sensory stimuli *created* by the old pattern in turn drives the motor response that constantly *re-creates and perpetuates* the old pattern. It's a self-sustaining loop or cycle, and we are trying to stage an intervention.

Mobilizing/stretching one part and hoping that the habit driven and usually oblivious nervous system will somehow automatically start moving in that unfamiliar place instead of its' usual path of least resistance is wishful thinking. Rather, we need to fashion tailored movements within specific functional contexts that *simultaneously stabilize the hypermobile part while mobilizing the hypomobile part*.

Because of the phenomenon of nervous system habituation and accommodation, the hypermobility/hypomobility pairs need to be addressed and treated in tandem and within a larger context of functionally relevant movement. One area needs to move more and one area needs to move less—an integrated relationship is required, so integrative exercise is needed. A new and improved sensory-motor loop needs to be established.



Extrapolating from Sahrman's movement impairment universe, we can also describe *relative strength*. Weakness in one muscle group will cause compensatory effort at other muscle groups (locally, regionally and globally). Hypertonicity stresses are created and nervous system habituation (as above) will tend to perpetuate the imbalance in daily activities even when successful interventions have been made to strengthen under-performing muscles. Strengthening a muscle does not automatically train it to do a particular job—working (or not working) within particular functional contexts, coordinating with specific synergists and inhibiting specific antagonists, with precise timing and proportion of muscle effort.

We will want exercise that *simultaneously* strengthens some muscles (locally) or muscle synergy groups (regionally and globally) while relaxing, lengthening or inhibiting others, again within a larger context of intentional activity. There is both a positive/go and negative/stop aspect to movement. Something has to work as something else needs to let go. As this yin/yang of muscle antagonist cooperation is present in daily life, so should it be present in our exercise prescriptions. Hence, *antagonist balance* is more important to optimal organization than the absolute strength of any one muscle. Smoothing out the reciprocal inhibition mechanism between local and regional antagonists pays higher dividends than adding more reps or more weight, as balanced antagonists correlate to a balanced skeletal structure.

There are many other authors exploring this topic, and many more studies researching this regional interdependence paradigm. Here are a couple of overview articles or summary resources on regional interdependence (3-4). There are also several articles illustrating regional interdependence in the low back (5-7), knee (8-11), neck (12-14) and shoulder (15).

Perhaps this is new to you or maybe I'm just preaching to the choir—either way I wanted to show that there is ample evidence out there to justify the continued exploration of this theme of integrated or regionally interdependent movement. This research is by no means complete, but it is a decent start.

In this next chapter, specific terminology is introduced or proposed that is quite handy for describing the relationships of various parts or regions to one another. This language helps us in framing the problem or *naming the pattern* in our assessment, and in devising a movement-based treatment approach that addresses a

**“The language we use
influences the way we think.”
Steven Pinker**

faulty pattern with a *corrective pattern*. Apologizing for the use of terms that are not universally known in the rehab world, I would have used already existing terminology to describe these interconnections—if they had existed.

If I've missed the memo and there is already someone who has coined widely accepted language that describes these associations or relationships, I'm open to making revisions. If the language is new or there is not something else that describes these regional alliances or affiliations, these patterns of movement and posture, we have to wonder why not. How did we, as experts in movement and with an increasing focus on synergistic relationships and whole body movement systems, not follow hallowed medical tradition and create some indecipherable jargon that describes them?

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