The Paradox of Unstable Stability
or
Who the Hell Needs Balance?

by Moti Nativ

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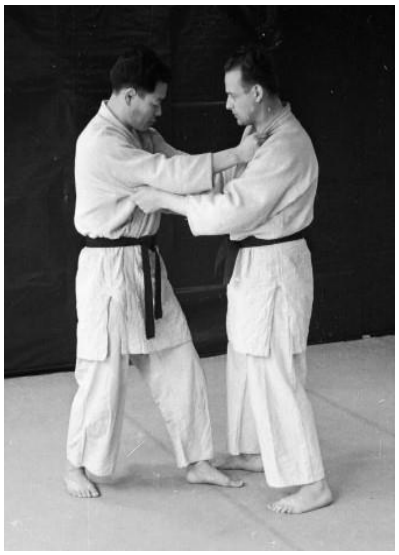
Introduction to the Paradox

Moshe Feldenkrais often refers to the unique stability of the Judo Master. He writes: "We are used to hear extolled the extreme "stability" of the Judo expert and it sounds somewhat ***paradoxical*** *to find the word "unstable" used to describe his action. We have seen that the Judo master behaves as if his body were governed by the principles of "unstable balance" and that he achieves better results than other people even when he has a handicap of weight and strength. "Moshe Feldenkrais, "Better Judo",*
Budokwai Bulletin (London, April 1948)



These things are not obvious to many and can also appear to be a paradox. If you are among these many, join me on a short journey of investigations in which we will try to unravel this complexity.

During this journey I will try to integrate some basic physical/mechanical facts on balance and stability. I will do my best to write simply and concisely. I will quote Moshe Feldenkrais' words on the subject, and his book Body & Mature Behavior (B&MB) will be my guideline. To this I will add from my personal experience, my insights as a researcher of these means and as a practical teacher for perfecting stability.
I hope this article will help you understand the subject and enable you to address the components of stability with more assurance when you are exploring the *Feldenkrais Method*.

On a personal note

I will begin with a personal story, which resulted in this article.
At the end of November 2012, I had a hemorrhage stroke that resulted in bleeding in the left side of the brain in the basal ganglia area. I lost control over the right side of my body, which affected my stability and balance.

My hospital bracelet said *Liable to fall*. I was only allowed to walk under supervision; however, I managed to slip away and wander around by myself. To all the anxious and worried people around me I explained that as far as I was concerned, it was OK to fall. They were dumbfounded. My attitude was not accepted as normal. I underwent an interesting period of re-learning, and the phrase "awareness through movement " gained a whole new meaning for me. Every step I took and the vivid sensation of my foot touching the surface I stepped on was different from any other experience I had had in the past.

Definitions and delineation

In 1932, Walter Bradford Cannon, the American physiologist, defined the aspiration to stability in living organisms as "homeostasis"[1].
This article addresses the human aspect of stability during movement. Stability is the foundation of human action in a changing environment and it is this foundation that allows the existence of the principle of *homeostasis*.
I have been investigating the matter of stability for many years. I have written and lectured many times on this topic. As I taught more and gained insight from working with diverse groups of students in the *Feldenkrais Method* and martial arts, I noticed the participants often had difficulty understanding theoretical explanations.

Practical, experiential learning is very helpful for understanding the theory!
The first hurdle is terminology. The terms we use originate from the fields of physics, mechanics, and mechanical systems in general terms that also apply human movement. The problem is that there are many definitions and formulas concerning the subject of movement and stability. If we glance at various studies, we find that there is no consistency in the terms used by researchers. This is a bit annoying, and indeed, Jackie L. Hudson from California State University, in the symposium "Biomechanics of Balance: Paradigms and Procedures"[2], pointed out different, and sometimes contradicting, presentations of terms on the subject:

"Stability's antipode is instability for Broer (1960), but for Luttgens et al. (1992) it is mobility. While Luttgens et al. posit an inverse relationship between stability and mobility, Moore and Yamamoto (1988) echo Hellebrandt (1940) by saying that an activity can have both stability and mobility at the same time."

Moshe Feldenkrais referred to stability in almost all his works, those commonly categorized as the *Feldenkrais Method* as well as those published about Judo. We can see that even though he had a scientific background, he took pains to present the subject of human balance and stability as simply as he could, but even he did not always use the terms in the same precise way in all his words and writings.
To proceed successfully through the article I propose a unifying definition. I believe that this definition fits with Moshe Feldenkrais concepts of stability. This is the key I use when I teach, so please excuse my impertinence, but you can call it "Moti's key for safe balance".

This key is composed of five major components:

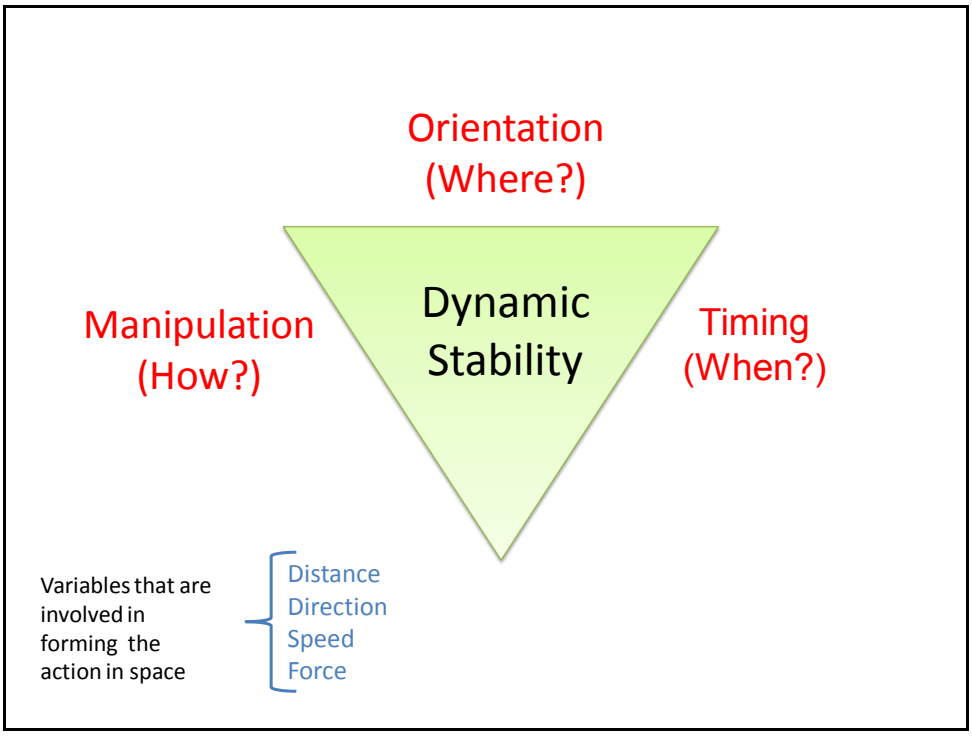
1. Balance
2. Stability
3. Motoric function
4. Orientation in space
5. Timing

Here is the concise explanation of the key:

- Safe balance is a necessary condition for daily functions.
- Safe balance is a physical and *mental* state following the basic rule that the center of mass is above or aligned with gravity so it is within the bounds of the base of support.
- Stability guards balance so that the person will not lose it, or if he does, he can restore it.
- Stability is an action with traditional components and is determined by the effective functioning of the musculoskeletal system. In Feldenkrais' language the term is *manipulation*. Our orientation in space, in the sense that we know where we are and where we want to go. And our timing, in the sense of the time we perform our movements.
- Manipulation includes our movements in the kinesphere[3] (movements while staying at the same place) and our mobility (transportation of the body from place to place).
- Timing – includes the time we begin to move and the time we complete the movement.

- The level of stability is the outcome of each component: the ability to perform a variety of efficient movements, the ability to move confidently and purposefully to a safe place at the right time in response to the changes in the environment.
- In daily language, these components present the How, Where and When, we act.
- There is dependence between the three components. For instance, timing is affected by speed and distance of the action, orientation is affected by the direction and distance.
- The three components of stability have dynamic properties and therefore stability is dynamic.

Schematically we can outline the stability triangle:



The triangle indicates the important fact that stability is an action as any other action we do. The **key** applies to ordinary human activities, which can be perfected with the tools of *Awareness Through Movement*. We can focus on perfecting each component, but in action all three overlap and cooperate. Each contributes its share to stability, as specifically required by necessity and environmental conditions. Harmony between the components is the formula for success.

Lyapunov's Principle of Stability and definitions of Balance

Even though I am doing my best to write as simply as I possibly can, it is not so simply done. I will start the discussion with a brief description of a basic mathematical principle–the principle of the stability of motion. I first stumbled upon this principle when I was visiting Tokyo two months after the tsunami. I was wandering around the book stores in my favorite quarter, Kanda. I chanced upon a used book titled The Stability of Motion. As it was an English book it was lying in a pile of very cheap books outside the store. The title immediately captivated me. The book, published in 1961 was a translation of a Russian book by N. G. Chetayev.[4] The entire book was dedicated to the formulation of the stability of motion by the mathematician Alexander Lyapunov[5].

Chetayev wrote introductory remarks going back to Galileo and Newton. He simply wrote that small forces and deviations disturb the system in equilibrium and stated that *"Equilbria and Motion which are only slightly disturbed by these apparently negligible deviations are termed stable; those which suffer extensive disturbance are termed unstable"*.

According to Lyapunov's formulas, a dynamical system is stable if all solutions of the system that start out near an equilibrium point stay near the equilibrium point forever. This is also termed **Lyapunov stable.** Of interest to us is the formula of *asymptotic stability*, which means that solutions that start close enough to the equilibrium not only remain close enough but also eventually converge to the equilibrium.

Lyapunov's principle of stability became a fundamental concept in the development of mechanical systems and in studies on stability. In 1952 the scientist I.G. Malkin, wrote: *"This work by Lyapunov became the starting point for further investigations of the theory of stability of motion*".

The terminology used by the scientists might confuse us. Jackie Hudson (see, page 3) also clarifies definitions of balance:

"The physicist will equate the term balance to the term equilibrium because, by definition, when a condition of equilibrium exists, all forces and all torques are equal to zero. In other words, they are in balance (or there are no unbalancing forces or torques)."

I use the term *balance*, rather than *equilibrium*, as it is more applicable when referring to the human body. Relevant to this article are the terms: *stable balance* and *unstable balance*. A system is in a state of stable balance if a small disturbance does not move it away from the present location. That is, a slight movement of the system will not produce enough energy to shift it from the point of balance. The system will be defined as unstable when, following a disturbance the system moves away from the balancing point; a slight movement in any direction will disturb the balance and place the system in a new location of balance and possibly in a different position.

Chetayev defined a basic principle: *"In a system of solid bodies in a state of equilibrium, the centre of gravity occupies the lowest relative position possible."* This principle is important to progress in our journey because states of balance can also be diagnosed according to the direction that the center of gravity is moving to in response to force applied on the system.

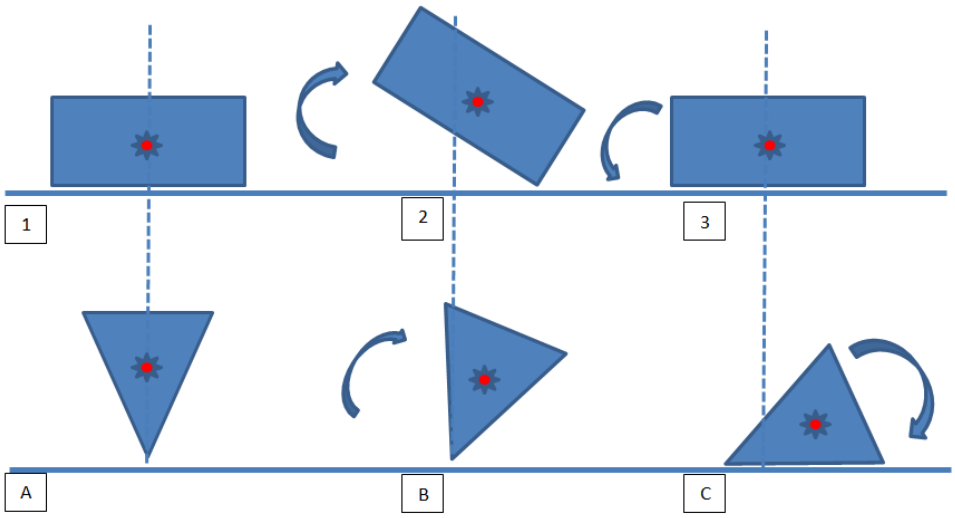


Illustration of bodies in stable and unstable balance

The rectangle represents stable balance. Minimal force will raise the center of gravity, and then it drops down again and stabilizes itself at the original balance point. To move the rectangle we must apply force that will be strong enough to lift the center of gravity until the rectangle can move and stand on a different edge.
The triangle on its vertex represents unstable balance. Minimal force lowers the center of gravity until the triangle stabilizes itself in a new point of balance.
It is evident that stability is influenced by the ratio between the height of the center of gravity and the width of the base of support. Generally, the structure of a system is significant in determining the degree of its stability/non stability. The attributes of our natural upright posture are not far from the stability of the triangle.
The human body structure determines that natural, upright posture is actually unstable because of the relatively high location of the center of gravity and its narrow support base, meaning that the center of gravity will go down during movement.
Moshe Feldenkrais is more stringent and in B&MB describes our standing posture as a *"system of three pyramids with their bases uppermost, balanced on top of one another...We thus obtain a system of three inverted pendulums balanced on one another."*[6]
Now we know that one element of the paradox is a fact – we are unstable!

The reflexes and dynamics of stability

The common attitude is that balance and stability describe a static condition. As long as a shifting movement, where the whole body changes its location, does not take place, it is customary to use the term *static stability*. But the reality is that in living creatures, moving on the ground in the gravitational field, balance and stability are dynamic and actively support the body's actions even when one is allegedly in a static position. For example: when sitting, the reflexes are constantly working to stimulate the appropriate muscles to support the body so it does not collapse under the force of gravity and, in doing so actually maintains the existing balance. When a person carries out an intended action, like walking, the reflexes intervene to ensure that the nerves and muscle systems maintain balance. All this happens unconsciously to a large extent. Even when standing, customarily seen as a static balanced position, the reflexes operate constantly to maintain this position. This condition, even though it seems static is, in actual fact, dynamic.

In B&MB, Chapter 7, *The Antigravity Mechanisms*, relying on Sherrington's law[7], Moshe refers to the corrective reflexes operating outside of intention and writes: "*The body tends thus automatically to bring itself into the proper position relative to gravity after it has been brought out of it by the conscious activity.*"

In Chapter 10, *The Body Pattern of Anxiety*, Moshe explains how difficult it is to learn the act of breaking (restraining) a fall because of conflicting reflex reactions:"*The arms tend to flex in accordance with the inborn reaction to falling. Beginners, therefore, tend to hurt their elbows before they learn to control and inhibit consciously the flexion of the arms. Later they learn to flap the ground, i.e., completely dissociate movement of the arms from the instinctive pattern of flexor contraction elicited by falling*"[8].

It seems that reflexes that react independently do not always get along well with the situation of lost balance or unintentional falls. A conflict is created between the brain and the reflexes, leading to anxiety and uncontrolled action. We saw a concrete example of this in the Wimbledon Tennis games, summer 2013, when seven professional players were injured by falling in a single day.

When the body gets out of balance, the center of gravity naturally looks for a lower and allegedly safer location. This can also be achieved through an act of falling that indeed brings the center of gravity to the lowest point, but falling is usually not a controlled act. Therefore we cannot talk about stability without referring to the act of falling that, although it has different aspects, is primarily associated with loss of balance and lack of control. However, there is still the possibility to act when the reflexes remain calm. For example, if we consciously drop our body, our reflexes will not interfere and we will have full control of the action. Of course, the ability to fall has to be learned.

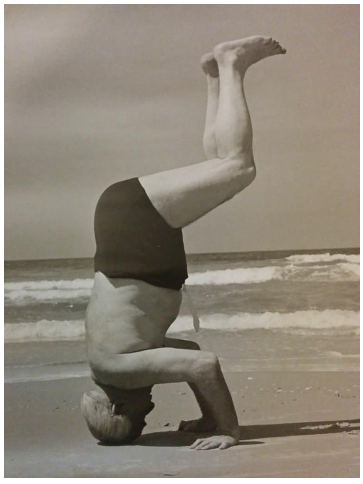
Falling and stability complement each other. This issue justifies a separate article and I'd be happy to do so in the future.

The uniqueness of the human being - pre-choice, learning, and emotions

The moment we begin an action, we are subject to the mechanical laws of physics that rule our movements. Lyapunov's formulas of stability deal with mechanical systems, though conceptually they are valid for us too. I propose to demonstrate the uniqueness of human beings in comparison to mechanical systems. Humans can decide in advance on the measure of stability and also change it intentionally. Man is unique in his ability to take the risk and the chance of making a wrong decision. Detecting a mistake, a corrective act may arise. The corrective action will improve the action and it will be instructive.

Moshe Feldenkrais in his book, The Elusive Obvious, opens the chapter *"Biological Aspects of Posture*" with the extreme example of a boxer falling to a stable position on the boards. In this state he is protected by the competition rules; he cannot be touched. If he chooses to stand again, an unstable position, he will be able to attack. Moshe Feldenkrais presents this concept: "*Stability (when one is protected) increases the feeling of safety. Instability means risk but easy mobility. Both are biologically important. Becoming addicted to one of them makes one unsafe for lack of choice.*"[9] This statement is important for people using the *Feldenkrais Method* in general, and particularly in relation to the point I want to emphasize: the human potential for choice of action and the degree of stability at the time of the action. Moreover, what distinguishes humans are the emotions related to the physiological bodily changes during the action. Emotions are actually evoked during the action and even affect its implementation. See the principle of William James: "The Theory of Emotion"[10].

I found a relevant example of emotions connected to human action in a letter written by David Ben Gurion, first prime minister of Israel, (translated from Hebrew):



"Feldenkrais went on a trip to London for six weeks. His last exercises with me were to stand me on my head. In his presence I did not succeed in performing it correctly. And just here the secret became clear to me: Since I was not afraid of falling – I did not fall, and I found the correct position. Now I do headstand also in my room with no fear of falling" (Ben Gurion at the age of 71, September 15th 1957).

Ben Gurion describes the change in his feelings during an action, from unsuccessful attempts accompanied by fear of falling until his successful headstand and the sense of security that comes with it, meaning that learned motoric skill generates an emotion. A hint of Ben Gurion's learning process can be found in Moshe's introduction to The Case of Nora, "*Often we do not see this kind of learning at all; it can go on for more or less lengthy periods of time, apparently aimlessly, and then a new form of action appears as from nowhere."*[11]
The uniqueness of man is manifested in yet another thing. Although, as any mechanical system, he is subject to laws of physics, he is unique in having infinite degrees of freedom in his musculoskeletal system and in the existence of a central nervous system that is capable of controlling the endless possibilities it provides.

Unstable balance and readiness of the body for action

In A.B.C. du Judo, the first Judo book (1938) Moshe Feldenkrais wrote, he dedicated the chapter *"De l'equilibre"* to present simply, maybe for the first time, the dilemma of stable balance against unstable balance. Of course, being an engineer he was familiar with the physics definitions:
"In physics one distinguishes two kinds of balance: stable and unstable balance. In stable balance the center of gravity of the body should be at the lowest possible point. A stick or a man lying down are simple examples for that. Unstable balance occurs when the center of gravity is high but aligned vertically above its points of support. . . . Such balance is easily broken up, and the body falls into a stable balance position. . . . This very simple scientific fact is the very basis of judo." (pages 14-15, translated from French).
For another perspective on this subject we can consult S. K. Uyenishi's[12] book Ju-Jitsu as practiced in Japan.

Moshe Feldenkrais held the copy of S. K. Uyenishi's book pictured here below in his hands when he wrote his Judo books in England. We can see that he drew ideas from the Japanese expert Uyenishi, who did not have a scientific background, and explains that in the erect position it is easier to maintain balance:

"The human body, as everyone knows, is (or should be) carried erect on two legs and the reason for this must be apparent to anyone who will ask himself the question why.

The reason is simply because, in the first place, it is better balanced, and secondly, because the balance is more easily maintained in erect position."[13]

This also seems a paradoxical statement, because Uyenishi claims that the erect position, by definition an unstable posture, actually has the best stability.
Walking is clearly an ordinary daily action – isn't it? You can see that this is an action also based on the apparent paradox of stability of an unstable system. So, I will use it to demonstrate the "key". Walking is the basic way in which the person mobilizes himself in the erect position. In ordinary walking we consciously lose balance and recover it by transferring the other foot and setting it down in the appropriate place, in the direction we are advancing towards. The center of gravity goes up and down, depending on the efficiency of the walking. It is a common routine of mobility and orientation. Walking represents stability that enables us to lose balance in order to find it again at a different point in space.

In Body and Mature Behaviour, Chapter 8, *Erect Posture and Action,* Moshe explains the advantages of unstable balance. When the center of gravity is high there is maximum potential energy. In this situation, movement feeds on the accumulated potential energy.

Movement is fueled by three main types of energy:

1. Potential energy that represents the energy stored in the system
2. Kinetic energy created by the motion of the system
3. Chemical energy that “feeds” the muscular activity.

The act of walking integrates the three energies. As the integration is perfected, so walking is improved, and vice versa.
In ideal movement, meaning movement without energy loss, there is faultless transfer between kinetic energy and potential energy (both gravitational and pulling forces on tendons, like a spring’s energy potential). In the physical world there is a process of energy loss, therefore chemical energy that is translated into movement through muscle action comes into play to, on one hand, preserve the movement and, on the other hand, to control the movement.

The physical principle Feldenkrais brings up here leads me to digress slightly from the subject of this article and mention Maimonides, the RAMBAM[14] . Maimonides assumes that movement has much significance – significance that is beyond movement in itself.

In his book A Guide for the Perplexed[15], in Part II Proposition Five, he wrote: "*Motion implies change and transition from potentiality to actuality.*"
This famous phrase by Maimonides was inspired by the seminal topic of potentiality and actuality, which Aristotle introduced into philosophical discussion. Maimonides phrased it similarly to *Awareness Through Movement,* in which we aim for change in our self-image so we can bring our potential abilities to realization (actuality).

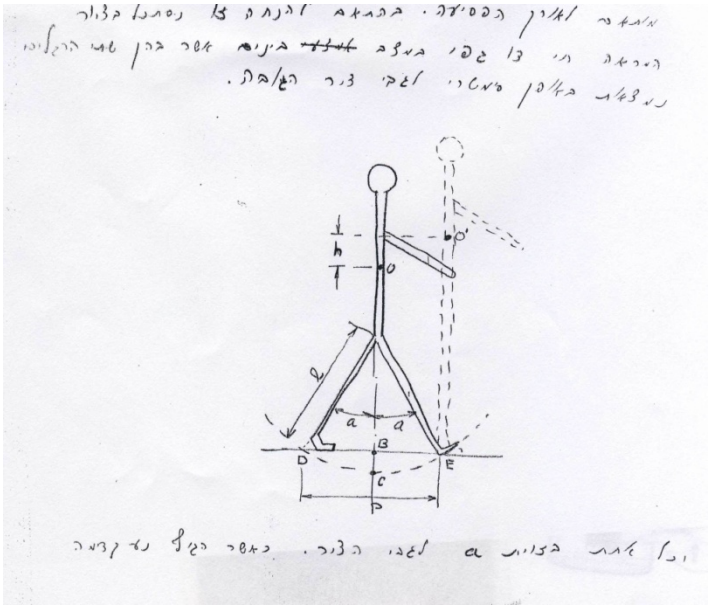
Feldenkrais lists the advantages of functioning in a state of unstable balance: "*…it can initiate movement in any direction with the same ease…it can start any movement without a preliminary adjustment…the movement is performed with the minimum of work, i.e., with the maximum of efficiency.*"[16] The significance of these advantages is the quick response time to the change in the environment.

The relevance of the term *time* is apparent in the physical definition of movement: a change in a position of an object with respect to time and its reference point. Maimonides referred to *time* and *movement*: *"Fifteenth proposition: Time is an accident that is related and joined to motion in such a manner that the one is never found without the other. Motion is only possible in time, and the idea of time cannot be conceived otherwise than in connection with motion; things which do not move have no relation to time."* This uncompromising assumption of Maimonides is supported by the laws of physics; Einstein named *time* as the fourth dimension of space.

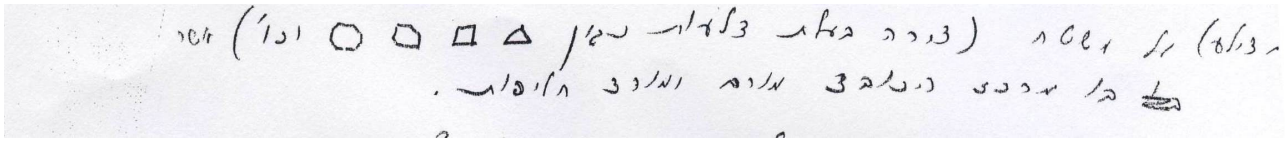
Our interest in *time* is as a component of organized movement, in other words, movement at the right time. In this context, Feldenkrais emphasizes that when there is the principle of maximum energy "*The standing body is thus ever ready for translation movement at short notice*". He argues that "*any deviations from that principle must be considered as inadequate; in other words, to maintain the body in a way such that the center of gravity is lower than it could be annuls the advantages recognized in the principle* "[17]
Moshe uses this principle to describe the right way of walking according to the movement of the center of gravity with relation to the ground:"*The center of gravity of the human body should go up and down so slightly that it is practically maintained at the level at which it is when standing on the forward foot, with the one behind still touching the ground with the two bigger toes.*"

Concerning *mobility*, I would like to recount one of Feldenkrais' lectures, presented to a forum of scientists in 1953, when he served in the Israeli Defense Force's Science Corps. Moshe Feldenkrais lectured on the subject of *Movement and Transportation in Nature*. He presented a thesis about human mobility by means of the mechanisms of jumping, running, walking and crawling, and of the force and energy required to perform these of movements.

Dr. Uzi Sharon[18], who attended the lecture, wrote a precise record and gave it to me in 2009, a year before his death. Enclosed was a diagram of the act of walking the way Feldenkrais described in his lecture:



In another diagram from the same lecture, you can see the sophistication in Feldenkrais' presentation of the efficient act of walking.



Rolling a polygon on the surface raises and lowers the center of gravity. As walking improves, the polygon will have more segments, so the center of gravity will move almost to the same level with every step.

Sense of balance, CNS and musculoskeletal system

Among the senses of man, we must remember the sense of balance. Even during the most regular action our system constantly relates to balance. Balance occurs without conscious intervention, but we react to any change that can result in its loss. Sometimes we do it without special attention, for example, taking a small step in order to expand the base of support, or stretching out a hand for gripping support may be done without even realizing it. Maintaining balance is certainly a major objective of human activity (see, end note1 Homeostasis).

Multiple systems are operating at the same time to identify changes in the body and its position relative to the environment, and to report these changes to the higher systems of control:

1. The somatosensory system consists of a multitude of sensors that sense the position and velocity of all body segments, their contact (impact) with external objects (including the ground), and orientation in gravity.
2. The vestibular system, which senses linear and angular accelerations, is our gyroscope.
3. Vision is the system primarily involved in planning our locomotion and in avoiding obstacles.

We witness people functioning even though one of the systems fails. This brings us to the important observation that there apparently exists a certain degree of redundancy. Information received is processed in the higher level of the nervous system by three centers in the brain: cerebral cortex, cerebellum, and basal ganglia. These centers transfer the instructions for the motoric act to the musculoskeletal system.

I would like to elaborate a little about the basal ganglia.[19] In my lectures I quote Purdon Martin[20]*,"There must be some centre or "higher authority" in the brain...some "controller" we may say. This controller or higher authority must be informed of the state of stability or instability of the body."*
Following Purdon, studies were undertaken that led to conclusions about the role of the basal ganglia. For example, Prof. C. David Marsden writes *"Most of the discussion … on the role of the basal ganglia in the control of movements has concentrated upon those of the limbs and eyes. However, clinical observations of the consequences of basal ganglia disease in man, and of the effect of lesions of the basal ganglia in animals, clearly indicate that these structures have a major role in controlling posture, equilibrium and locomotion."*[21] Marsden quotes from Purdon's work, where he brings evidence about the role of basal ganglia dating as far back as 1920.

At this point I want to tell you a little bit of my own personal experience. I believe it will provide useful ideas for your explorations.
After the stroke, the most prominent feeling was dysfunction in my right side and slow reactions. As I mentioned before, I had a problem of instability. This is the result of damage to the basal ganglia. I felt that reports of loss of balance reached my brain late, extrication reaction was then delayed, and when it came, it was hasty and exaggerated.

We learn from various studies that exaggerated movement is indeed a delayed reaction to indentifying the danger of losing your balance. For instance, in Jian Liu's study from September 2012[22], measurements showed that there was a significant difference between the three study groups. The group prone to falling always invested more

energy just to remain standing. This is a logical outcome; when your balance control system is damaged, you sense not being in a stable state later than a healthy person does, and thus your corrective act will be more violent.

Since I felt comfortable falling, my system immediately relaxed. I stabilized myself or allowed my body to fall safely, but because I was complicit in the act of falling, I rarely did, and the few times I did fall I was in motoric control and oriented to my environment. Intermediate states are also possible, meaning that a fall must not always end with lying flat on the face or on the back. We must take into account that a relatively long time elapses from the moment of stumbling until re-stabilization, time that may be sufficient for making the required adjustments to protect the body.

I have mentioned manipulation and timing, and now we see that space must be connected to these elements. Here I will recruit another well known philosopher, Immanuel Kant, who argues that space and time are both *pure forms of intuition* because they must precede and structure all experience of individual outer objects and inner states; we cannot represent any objects without representing space and/or time. Therefore an a priori image of an action, as we frequently use in *Awareness Through Movement*, must include time and space, and so is the practical action.
Indeed, from my experience I can confidently say that perfecting the ability of movement increases the efficiency of response to external power that threatens the balance.

Here we can raise the question:

Do we focus on learning the skills of falling or on learning intermediate movements such as moving towards bending or kneeling? In actual fact, any improvement in the ability to change position prepares us for the act of falling. For example, the complete set of the 4 points ATM lessons are effective for dealing with the threat of loss of balance. However, in these lessons it is very important to adjust the duration and speed of the lesson (taking into consideration the degree of protection the surface offers) to the students' abilities.

Dynamic Stability – solving the paradox

I have tried to shed light on *stability* and its role in the movement of humans in space. Now, let us advance towards a clearer picture of the connection between stability and unstable balance, and try to find the solution to the paradox we presented in the beginning.

We can reach the conclusion that the concept dictating that connection is *dynamic stability*, which I implied at the beginning and illustrated with the Stability Triangle (see, page 3).
Dynamic stability is the ability to react effectively to a disturbance that takes us away from equilibrium and balance. This is a *controlled dynamic action* that enables us to remain balanced or return to a state of balance. In his book Higher Judo, Moshe Feldenkrais points out dynamic stability as one of the skills learning Judo cultivates: *"Dynamic stability is stability acquired through movement"*.

In *Body and Mature Behaviour*, Feldenkrais connects unstable balance and maximum energy with dynamism, *"The erect carriage is assured not by static stability but by ease of dynamic adjustment to the position of maximum potential energy…Functionally, stress must be laid on the dynamic character of the erect posture…"*[23]
A release from the feeling of paradox can be found in Feldenkrais' assertion that *"In reality, the unstable balance is essentially a dynamic state through which the entire system passes in each act as through a station where it takes its bearings and readjusts all the instruments sensitive to gravity in order to better its relation to space and improve its timing."*[24]
A simple example familiar to us all will serve to clarify the above statement. A person in the act of natural upright walking encounters an obstacle and loses his balance. In response to the situation he leaps or takes several quick steps that enable him to restore his balance. From a bio-mechanical standpoint, the person hurries to spread the base of support under the center of gravity so he can maintain the basic rule of safe balance. This response meets the definition of dynamic stability.
Moshe Feldenkrais closes the circle when he connects the dynamic stability, for all its advantages, to the natural standing stance of Judo: *"The Shizentai is essentially the potent state we have described. The graceful, precise, and efficient movements executed effortlessly and without delay in any position and at any instant are made possible by maintaining the center of gravity at the highest potential energy level possible."*[25]

In *The Potent Self,* Feldenkrais writes about correct posture, *"As already discussed, posture relates to action, and not to the maintenance of any given position. Acture would perhaps be a better word for it"*[26]. When I first read this sentence I saw in my mind the term ACTion and postURE combined - ACT + URE. I did not find the term in the dictionary and I was sure that this was another of Moshe Feldenkrais' brilliant inventions. It is also interesting that the Hebrew translation is *matzav hachen*, meaning a state of readiness. This expression is connected to the concept of Kamae – the stances martial artists take while executing their defense and attack techniques. As the skill level rises, those stances are combined into the dynamic movements of the martial artists – Shizentai is the "acture" that Feldenkrais describes as an alleged paradox.

The Judo expert utilizes the mobile ease of upright standing. This mobility enables him to lose and regain his balance. He does not resist the strong pull of his opponent, but moves his body lightly in the direction of the pull to a new point, safe in terms of balance.
Furthermore, the Judoka controls his stability and at the same time creates points of weakness in his opponent's stability. *"It is the perfect knowledge of balance, the manner of breaking it and of recovering it which enables the Ju-Jitsian to throw the opponent to the ground with ease without "using force" in the usual sense of the term"*[27].

is advanced, so if you move slightly to your right while pushing off his fist you are in an ideal position to push his left foot in the direction of its toes, hooking it from behind with your right foot. A sharp pull at the sleeve to your right coinciding with the hooking of your right foot will bring the assailant to the ground.

You certainly won't let go the sleeve, if only from habit, and it is a good thing to hold on to. Should

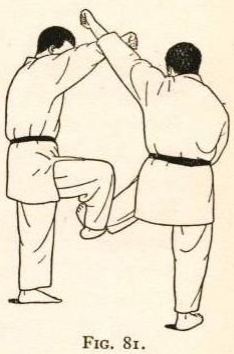


FIG. 81.

On the left Unishi demonstrates ankle throw (De-Ashi-Barai); on the right Feldenkrais is using the technique against an assailant punching to his face. It is possible to sense the control of stability and balance while standing on one foot.

In short, the posture of a standing man appears unstable at first sight, but the balance can be cleverly kept by taking the proper steps.The question is: do we need to specialize in Judo in order to strengthen our dynamic stability? According to my thesis, Moshe Feldenkrais' knowledge and experience in Judo influenced the development of his Method, so that the technique of *Awareness Through Movement* contains the tools for improving the dynamic stability, and all the elements of manipulation, mobility and orientation.
I found a relevant and amusing remark of Feldenkrais's from the book Higher Judo, "*We may say, therefore, that the adult body stability is dynamic and that relying exclusively on the size of the standing base and lowering the centre of gravity, is truly an infantile feature.*[28]"
I would like to conclude with a term Moshe Feldenkrais coined concerning Judo, which could have been suitable for the title of this article: *gravitation independence*. Concerning this ability he wrote," *In furthering adult individual independence from gravitation, Judo stands far above any other method.*"

That's it for now

I have touched upon balance and stability of in everyday actions and tried to put concepts into a logical chain of thought. I needed this minimal amount of writing to share with you my understandings and feelings on the subject, including a few tips on practical use of the theory. While I walked with you on this journey, trying to keep my balance, I stumbled on some general concepts of the *Feldenkrais Method* and I integrated them into my writing.

Hopefully those of you reading these lines managed to toil through the length of it. I thank you for that, and if it simplifies things a bit or will be of any assistance in the teaching of Awareness Through Movement, I am rewarded.

I'd like to sign off with Dr. Seuss from his book, Oh, the Places You'll Go!

So be sure when you step.
Step with care and great tact
And remember that life's
A great balancing act.

Moti Nativ, Tel Aviv
December 2013

Footnotes

[1]Homeostasis: The ability of the body or a cell to seek and maintain a condition of equilibrium or stability within its internal environment when dealing with external changes. *"The coordinated physiological processes which maintain most of the steady states in the organism are so complex and so peculiar to living beings – involving, as they may, the brain and nerves, the heart, lungs, kidneys and spleen, all working cooperatively – that I have suggested a special designation for these states, Homeostasis"* (Canon, The Wisdom of the Body, 1932)

[2]M. Spina, J. Spence, T. Ciapponi, F. Christ, A. Caldwell, T., J.L. Hudson. *Cleary Biomechanics of Balance: Paradigms and Procedures*, 13th International Symposium on Biomechanics in Sports; Thunder Bay, Ontario, Canada, July 18 - 22, 1995

[3]The concept of a "kinesphere" was defined by **Rudolf Laban** as the "space which can be reached by easily extended limbs"

[4]N. G. Chetayev, Translated from the Russian, by Morton Nadler The Stability of Motion, New: Pergamon Press. 1961

[5]**Alexander Mikhailovich Lyapunov** (1918-1857) was a Russian mathematician, mechanic and physicist. Lyapunov is known for his development of the stability theory of a dynamical systems in 1892. One of his main preoccupations was the stability of equilibria and the motion of mechanical systems.

[6] Moshe Feldenkrais, Body and Mature Behavior (Connecticut: Internationals Universities Press, Inc), 95.

[6]Sherrington's law: The law of reciprocal innervations: when one set of muscles is stimulated, muscles working against the activity of the first will be inhibited to an equal extent allowing smooth movement (The Integrative Action of the Nervous System, 1906).

[8] Moshe Feldenkrais, Body and Mature Behavior (Connecticut: Internationals Universities Press, Inc)

[9] Idem, The Elusive Obvious

[10]William James (1842-1910) – "Our natural way of thinking about these standard emotions is that the mental perception of some fact excites the mental affection called the emotion, and that this latter state of mind gives rise to the bodily expression. *My thesis on the contrary is that the BODILY CHANGES follow directly the PERCEPTION of the exciting fact and that our feeling of the same changes as they occur IS the EMOTION".* From "What is an Emotion?" by William James (1884)

[11] Moshe Feldenkrais, Case of Nora

[12]**Sada Kazu Uyenishi** was born in 1880 in Japan. When he was 20 years old he was invited to London by Edward William Barton-Wright, the founder of the eclectic martial art of Bartitsu. His abilities as a teacher were often remarked upon, and by 1903 he had established his own Dojo, the School of Japanese Self Defense, at 31 Golden Square, Piccadilly Circus, London.

[13]JuJitsu as Practiced in Japan, S. K. Uyenishi ,chapter 2 (Balance), page 24published 1905 (Courtesy of Bath University, The Bowen Collection)

[14]Mosheh ben Maimon, called Moses Maimonides, MūsāibnMaymūn (Arabic), orRaMBaM (Hebrew acronym for "Rabbi Mosheh Ben Maimon"), Jewish philosopher, astronomer, and one of the most prolific and

influential Torah scholars and physicians of the Middle Ages born in Córdoba (present-day Spain) in 1135, and died in Egypt on 1204http://en.wikipedia.org/wiki/Maimonides - cite_note-5

[15]Moses Maimonides, Guide for the Perplexed (translated from the original Arabic text by M. Friedlander, PhD)second edition revised throughout 1904

[16] Moshe Feldenkrais, Body and Mature Behavior , 104

[17] Moshe Feldenkrais, Body and Mature Behavior , 97

[18]Uzi Sharon (1926-2010), was a systems engineer that made a significant contribution in developing combat weapons, and was a key figure in the Israeli field of missiles and laser.

[19]**The basal ganglia** are a group of large nuclei that partially surround the thalamus. These nuclei are important in the control of movement. Damage to the basal ganglia cells may cause problems with one's ability to control speech, movement, and posture. A person with basal ganglia dysfunction may have difficulty starting, stopping, or sustaining movement. Depending on which area is affected, there may also be problems with memory and other thought processes.

[20]The Basal Ganglia and Posture (London 1967)

[21]Paul Marsden, Book of Movement Disorders(Oxford University Press, 2012)

[22]Jian Liu, Xiaoyue Zhang, Thurmon E. Lockhart *Fall Risk Assessments Based on Postural and Dynamic Stability Using Inertial Measurement Unit*(Safety and Health at Work Volume 3, issue 3, September 2012), 192-198,

[23] Moshe Feldenkrais, Body and Mature Behavior ,103

[24] Ibid, 103-104

[25] Ibid, page 105

[26]Moshe Feldenkrais, Potent Self (California: Somatic Resources, 1985)

[27] A.B.C. DU JUDO

[28]Higher Judo