The ALEXANDRIAN

VOL. II, NO. 2 A PERIODICAL OF THE ALEXANDER TECHNIQUE Winter 1983

The Body Moveable by David Gorman

Deborah Caplan, Reviewer

It is with pleasure that I am fulfilling a request to review a book titled *The Body Moveable, Blueprints of the Human Musculoskeletal System: Its Structure, Mechanics, Locomotor and Postural Functions.* This impressive three-volume work was written and illustrated by David Gorman, who is an Alexander teacher, anatomist, artist, and illustrator.

Gorman informs us that this work is to be used as a reference, and as such it should be particularly useful to Alexander teachers because of its emphasis on function as well as structure. The contents of each volume is best described in Gorman's own words from his Introduction:

"The first volume begins with an introduction to the physical characteristics and adaptability of the body tissues. It then explores the general principles of balance and body equilibrium and the mechanics of muscle and joint action. There follows a brief description of embryological and evolutionary development. Then the bulk of the volume covers the vertebral column, the chest and abdomen, the neck and the head, with expanded sections on respiration and the voice.

"The second volume begins with the embryological and evolutionary development of both the upper and lower limbs. It then covers the shoulder girdle, the shoulder, the elbow, the wrist and the hand. There is an expanded section on the use of the hand and the arm as a whole.

"The third volume covers the pelvic girdle with its sacroiliac connection to the spine, the hip, the knee, the ankle and the foot. There are expanded sections on the arches of the foot, the use of the leg as a whole and locomotion. "

In all three volumes the text provides detailed information on function while the excellent illustrations help the reader visualize structure. In the beginning of Volume I, information on the physical properties of cartilage gives the reader an appreciation of how the body is designed to deal with mechanical stress: "Articular cartilage is thicker where it must sustain more stress and thinner where the joints are more congruent. It is highly elastic and adapts itself to the joint contours under pressure to achieve the greatest possible contact." In the same paragraph the reader is then told why the way we use our joints has a direct bearing on how healthy our joints remain: "The longer the load continues on the cartilage the less complete is the elastic rebound after compression ceases. Thus, abuses of the joint (prolonged maintenance of the joint in one position or habitually repeated position) may cause degeneration or deterioration."

For those interested in increasing their understanding of respiration, there is a clear explanation of the often confused interplay between the diaphragm and abdominal muscles: "The activity of both sets of muscles . . . varies reciprocally. Thus, during inspiration the tonus of the diaphragm increases while that of the abdominal muscles decreases, and vice-versa during expiration. Hence there exists between these two muscle groups a floating equilibrium constantly shifting in both directions." This explanation is accompanied by diagrams and anatomical drawings.

(continued on p. 2)

Some Visual Problems and their Relationship to the Alexander Technique

by Frederic K. Nevins, Optometrist

There are various conditions of the eyes, both obvious and more often not so obvious, affecting us in ways which have nothing to do with seeing "20/20." What I am referring to are fusion difficulties, conditions in which the eyes deviate from their normal alignment and symmetry of one to another. These conditions are very common and can have a marked effect on our perception, gross and fine motor abilities, coordination, and reading ability. Other effects the Alexander teacher and student would be concerned with are headaches, neck and back aches, head tilting and turning, general excess of muscular tension in the forehead, neck, shoulders and back.

It is generally the rule that a person who suffers from fusion difficulties is not consciously aware of problems with his vision. In fact, fusion difficulties are not even commonly detected in the routine eye examinations most of us have from time to time because of the absence of apparent symptomology. Typically, these sufferers blame their problems on factors unrelated to the eyes.

The first condition I want to discuss is the tendency of the eyes to drift apart. This condition is known as exophoria and is very common. If, when looking at distance or near, the eyes tend to drift apart, then there must be an increase in muscular innervation to those muscles responsible for pulling the eyes back into alignment in order to maintain fusion or clear, single, binocular vision. This process must be implemented to avoid double vision.

The symptoms arising from a more than normal exophoria can include intermittent doubling of vision, tired eyes and eye strain, difficulty keeping distant objects in focus, reading fatigue and blurred print. Other common complaints are headaches, eye aches, and neck and back aches from the continual increase in muscular tension associated with the eyes.

In some instances, a person with a high amount of exophoria may attempt to relieve some of these symptoms by raising his chin. By doing this, the eyes automatically converge as the chin is raised and the head tilts back, helping to overcome the exophoria. This compensatory motion is a last ditch effort to maintain fusion. It may actually relieve some of the eye symptoms but will throw the rest of the body out of alignment, forcing the neck, shoulder and back muscles to strain in an effort to balance the body. This situation, in which the head, or about ten pounds of body weight, shifts backwards off axis, must be of paramount concern to the Alexander teacher.

A similar condition called esophoria is a problem in which the eyes have a tendency to turn inward. An increase in muscular innervation must take place in order to pull the eyes apart, maintain fusion and avoid double vision. The symptoms associated with this condition parallel those in exophoria. The esophore experiences an increase in muscular tension throughout the head, neck, shoulders, and back. Headaches occur frequently. Because the eyes want to point closer than needed for the object to be viewed, the tendency is to move the object closer to the eyes. For example, instead of reading at sixteen to twenty inches as is common, the esophore might read at eight to ten inches. This motion necessitates an

(continued on p. 2)

Published by the American Center for the Alexander Technique, Inc., a Non-Profit Educational Corporation
142 West End Avenue, New York, NY 10023 (212) 799-0468
Editorial Supervision: the School of Alexander Studies, ACAT-NY, Ronald J. Dennis, Director

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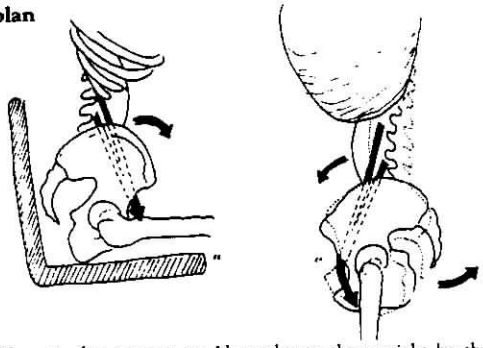

Of particular interest to Alexander teachers might be the way Gorman relates the use of the skeletal muscles to posture: "The psoas major (see drawing), acting from above, flexes the thigh upon the pelvis. . . . The habit of many people of holding this muscle (and iliacus) chronically in contraction accounts in large part for the posture characterized by exaggerated lumbar curvature and prominently displayed bums causing the forward-tilted pelvis." Also of interest to the same group would be his explanation of why "monkey" is a more efficient way to bend than the more usual "from the waist" method of bending.

David Gorman's work provides an excellent reference for musculoskeletal anatomy and function. However, extracting sought-after information from it may be hard for the impatient soul because of the density of the text, and may prove difficult for those not already familiar with anatomical and kinesiological terms. Each volume does, however, have a glossary. The text is hand-written, which for some may prove irritating. I was bothered at first, but soon adjusted and found that the writing is actually extremely legible. I now consider the hand-written text a charming asset which further distinguishes this work from many other anatomy books which either have no information on "use," or do not explain the close alliance of structure and function so well done in Gorman's work. I found some of the schematic drawings explaining the mechanics of joint action hard to understand at first reading. But when I wanted to gain more understanding of a particular joint, the information was there for the digging. The fact that color is not used in the illustrations (due to cost) is another drawback. I particularly missed the use of color in Gorman's section on the hand, and sometimes found myself lost in a jungle of muscles, tendons, ligaments, sheaths and tunnels which color would have helped clarify. However, his text on the functions of the hand was clear, informative, thought provoking, and occasionally poetic.

In general, I consider Gorman's work a treasure of useful and interesting information for those who want facts about the way the musculoskeletal system is built and works. Augmenting its informative value is the artistic quality of the illustrations, and the insights into inefficient versus efficient use of the body which clearly spring from Gorman's experience as a teacher of the Alexander Technique.

Gorman informs us that he is presently working on another book which carries on from these volumes and which he describes as concerning "patterns of use and misuse and the way that we think of ourselves." I am looking forward to enjoying, and learning from, this new work.

The Body Moveable has been printed as a limited edition of 600. The three volumes are sold as a set, and the current cost is $125. Orders may be sent to Ampersand Press Ltd., 123 Woolwich St., Guelph, Ontario NIH 3V1, Canada. Correspondence with the author is welcomed: David Gorman, 105 Crosby St., NY, NY 10012, (212) 431-9028.

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increase in focusing or accommodation of the visual system. A general tension is set up within the eyes and if maintained over an extended period of time, may in turn lead to the eyes becoming myopic or nearsighted. Muscular innervation of the face, neck, shoulder, and back increases in sympathy with the eyes, leading to symptoms familiar to the Alexander teacher.

The posture of an esophore is most certainly affected by this condition. The muscles mentioned above are strained in an effort to lean over a desk to get closer to the reading material. Headaches, neckaches and backaches are common, and the esophore may never even suspect his problems are due to his eyes.

As with the exophore, the esophore can make certain compensatory movements with his head in an effort to lessen the symptoms. By lowering his head and looking up to see, the eyes automatically diverge, thus, in effect, acting to neutralize the esophoria. This adjustment puts the body out of alignment, creates undue stress on the spine and is translated into muscular tension in the body. Neckaches and backaches are the usual symptoms.

One of the more interesting and most commonly overlooked problems of the eyes is a condition called hyperphoria. This is a condition in which one of the two eyes tends to drift up and out of alignment with the other eye. With hyperphoria, compensatory mechanisms are frequently used to bring the eyes into fusion to avoid double vision. These automatic compensations very often correct the tendency to double vision and almost always leave the hyperphore visually unaware of any difficulty with his eyes.

The most often seen compensation is a tilt of the head toward one of the shoulders. This motion artifically helps align the eyes but sets up all the problems of body misalignment. Headaches, neck and back aches are common and often quite severe. Reading ability frequently suffers. Victims of hyperphoria may find themselves losing their place, skipping lines and needing to slow up. Occasionally, tracing the lines of type with their finger becomes necessary. Difficulty in judging distances, especially if a moving object is involved, is not uncommon. Carsickness, particularly in younger people, is frequently seen and may be avoided by sleeping in the car. People with this vertical muscle deviation are almost always surprised to find out that they are sufferers of this condition.

All of the conditions mentioned above—exophoria, esophoria, hyperphoria—should be of paramount interest to the Alexander teacher. The compensatory mechanisms are established because a problem exists. If the Alexander teacher attempts to realign the body in these situations, his or her task may be extremely difficult. A striking example is the person with a hyperphoria and a compensatory head tilt to one shoulder. If the teacher attempts to correct this head tilt, the hyperphore begins to develop severe headaches and intermittent doubling of vision. Left alone, the hyperphore will soon resume the head tilt. In such situations, vision therapy should be instituted along with the Alexander lessons.

A more multidisciplinary approach is needed to these problems. I recommend a complete visual examination for all people beginning Alexander lessons in order to rule out any difficulties with the eyes which might be affecting the rest of the body. Conversely, it is incumbent upon optometrists to recognize postural problems their patients may have and to make the proper referrals for corrective treatment.

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The motor activity of organisms is of enormous biological significance—it is practically the only way in which the organism not only interacts with the surrounding environment, but also actively operates on this environment, altering it with respect to particular results.

—N. Bernstein

A Modern Theory of Coordination and Its Implications for the Alexander Technique

by Ron Dennis

This paper has its origins in my first Alexander lessons, where some questions came up that I pondered for several years before reaching some satisfactory answers. The gist of these questions was: "Why are the sensations of incredible lightness and ease in movement that I experience in Alexander lessons so different from those I experience when making the same movements by myself?" I recall asking my teacher about this, and being led to think there really wasn't any reason why I couldn't, in time, experience the same sensations by myself that I experienced in the lesson. But as time went on, although my commitment to the Technique grew, accompanied by perceived positive changes in myself, I continued to puzzle about this disparity in feeling between the guided and unguided movements.[1]

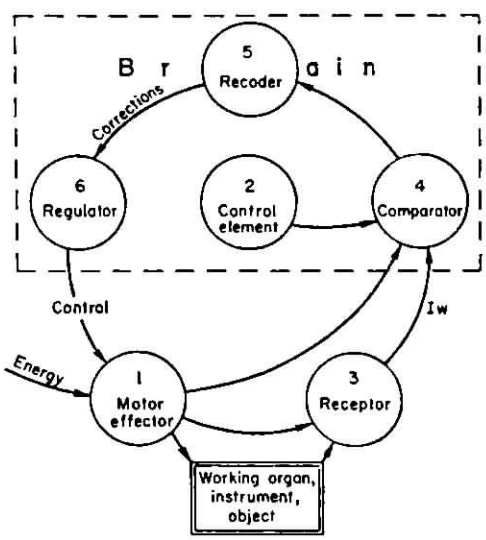
I think it was sometime early in the teacher-training (1977 or 78) that the essential answer struck me—that being guided in a movement was an objectively different phenomenon from doing more or less the same movement "unaccompanied." There was, in fact, someone else there in the situation, touching and guiding me, so that the experience necessarily had to be different from that of acting by myself. So, from a logical viewpoint at least, my questions seemed answered, but it was some time later before I encountered the ideas that extended my understanding.

These ideas are contained in the writings of Nicolai Bernstein, a Russian physiologist and philosopher who applied scientific and mathematical methods to the study of movements from roughly 1910 until his death in 1966. The results of his work are summarized in English in *The Co-ordination and Regulation of Movements*, a densely technical but curiously exciting book that has, I believe, many implications for the Alexander Technique.[2] I first came across Bernstein in an article called "On voluntary action and its hierarchical structure" by the cognitive psychologist Jerome S. Bruner,[3] and pursued my inquiry with some other sources which included a text on contemporary learning theory[4] and an article from *Scientific American* called "Brain Mechanisms of Movement."[5] I also found useful material in Norbert Wiener's *The Human Use of Human Beings*.[6]

I would state Bernstein's major thesis as follows: Coordination consists not only of progammed responses of the central nervous system (CNS) to external stimuli (the classical stimulus-response model), but consists also, and perhaps more so, of continuously monitored and modulated series of responses of the CNS to information arriving from throughout the system, and particularly from the proprioceptive mechanisms, the structures such as muscle spindles and tendon organs that inform the kinesthetic sense. In other words, in terms of controlling ongoing activity, events at the muscle and joint level (the "periphery," in Bernstein's terminology) are just as significant as events at the brain level. Furthermore, because of the extreme intra-connectedness of the nervous system, any change in proprioceptive input, however small, can radically affect motor output, so that apparently identical movements can have markedly different patterns of innervation, with consequently different muscular actions, depending on the state of the system at the precise time of the variations. In Bernstein's words, "Movements react to changes in one single detail with changes in a whole series of others which are sometimes very far removed from the former both in space and in time, and leave untouched such elements as are closely adjacent to the first detail, almost merged with it."[7] In Alexander terms, this suggests that guided movement is *innervationally* different from unguided movement, because the CNS responds differently to stimuli originating in the brain centers, as in movement initiated by intention, imagery, memory, etc., than it does to stimuli originating in the proprioceptive mechanisms mentioned above. It is this qualitatively different response of the organism to stimuli originating in different places in the system that I currently believe accounts in part for the difference in sensation between guided and unguided movements.[8] It feels different because it *is* different in some significant degree, however subtle. This seems very obvious to me now, but for a long time it wasn't!

The evidential basis for the foregoing is beyond the scope of this paper, but I would like to develop further a model of the behavioral system suggested by these concepts. This model represents the characteristics of *self-regulating systems*, sometimes called *closed-loop systems*. The theoretical treatment of these systems is *cybernetics* (from the Greek, "helmsman"), developed largely during and since World War II, and first applied mainly to weapons-control systems. A more familiar application is that of the furnace controlled by a thermostat—when the temperature in the house falls below a pre-set level, the furnace is turned on, and vice-versa. Living organisms are extremely complex self-regulating systems with both electro-chemical and mechanical aspects, speaking from the purely physical point of view. In terms of our line of interest, the purpose of the model is to represent both the structures and functional relationships of a system capable of coordinating its own purposeful movements.

The main operational characteristic of self-regulating systems is that they can both detect and correct their own errors.[9] Complex activities require ongoing evaluation as to whether the actual muscular actions are in fact implementing the necessary movements which are in turn producing the desired results. This kind of evaluation implies a *feedback* mechanism, which can inform the system of the neuro-muscular activity in progress, and a *reference* mechanism, which can compare the required value for the intended movement against the factual value of the feedback. Then this difference in required and factual values must be calculated and delivered as a modified output value, and then converted to the appropriate nerve impulses and resulting muscular action, which is then submitted again to the feedback process until the action is in some sense completed. Hence the name, closed-loop system, or in Bernstein's term, *reflex-ring system*.



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The diagram shows schematically the elements and relationships of this kind of system, particularly illustrating the role of sensory information in controlling activity. Looking at the diagram in terms of the furnace example mentioned above, the house is the "working instrument," with a sensory receptor for heat, a thermostat, which typically consists of a bi-metallic strip that arches one way or the other depending on the amount of heat present and the differential rates of expansion and contraction of the two metals forming the strip. The "controlling element" is a mechanism for adjusting the distance of an electrial contact from the strip, which determines how far the strip must bend before closing a circuit, and therefore how much heat is required to bend the strip that distance. The furnace itself, controlled electrically, is the motor element, its output providing heat for the house which is also information for the thermo-receptor. *Note that a change in the system's behavior can originate at any point along the circular path of activity.* This is the key concept in understanding how the lightest guiding touch can significantly affect the sensation and quality of a movement.

In terms of human neuro-muscular activity, relatively more is known about the motor and sensory systems, as compared to the little known of the controlling, comparing, re-coding, and regulating systems. Even the existence of these latter has not been established by direct observation, but has been largely inferred from the design theory and practice of man-made self-regulating devices.

I believe that Bernstein's conclusions have both theoretical and practical implications for the Alexander Technique, and will discuss them in that order. To introduce the theoretical implications, here is a rather long quote from Bernstein, which is in effect a digest of his theory of coordination:

The mastery of co-ordination must consist in the ability to give the necessary impulse at the necessary moment, *seizing the fleeting phases of higher conductivity of force and avoiding those phases during which this conductivity falls to low values. . . . The role of co-ordination at this level must therefore consist in the* preparatory organization of the motor periphery in order to guarantee optimal selection of conductivity. . . . *Co-ordination at the level described lies basically not in the character and accuracy of a tetanic [contractile] effector impulse but in the accuracy of some sort of preparatory (not tetanic) effector impulses* which organize and prepare the periphery *for the reception of the right impulse at the right moment. The co-ordinational process does not enter into the composition of the tetanic impulse, or follow immediately after it; it goes* before, *clearing and organizing the path for it, and therefore must operate through quite different paths and employ quite different innervational processes. . . . We find it very tempting to draw upon the concepts of* tonus, *a very generalized state of the motor periphery of preparation (in particular of the neck and body) for the accomplishment of positions or movements, to explain the phenomenon described here. . . . It is clear that these systemic reflexes of high degrees of plasticity, as studied by the school of Magnus, are decisive co-ordinational prerequisites to movements or positions and that their physiologic purpose is not limited to the communication of a necessary and simultaneous rigidity to the trunk of the body but incorporates the entire preparatory reaction of the periphery to the conditions of the external (static and dynamic) field of forces.*[10]

We seem to have here a striking support for Alexander's hypothesis of a *primary control of use*, but on a much broader neuro-physiologic basis than has yet been advanced. Alexander seems to have discovered empirically the phenomenon that Bernstein predicted theoretically. Paradoxically, in this case the discovery came before the prediction! Also, Alexander's processes of *inhibition* and *conscious direction* suggest themselves as possible psycho-physical counterparts of Bernstein's "non-tetanic preparatory impulses" that organize and prepare the organism for optimal coordination. Finally, every Alexander teacher experiences as a daily fact "giving the necessary impulse at the necessary moment, seizing the fleeting phases of conductivity," or as he or she may call it, "staying in the moment." In the foregoing considerations we see not only Alexandrian practice enlightened by Bernsteinian theory, but also the reverse, a significant correlation from a theoretical viewpoint.

In terms of practical Alexander teaching, I currently think it's important to let a student know from the outset that what he experiences with hands on will necessarily be different from what he experiences on his own. I often ask a student to follow a guided movement with a similar movement by himself, so that he experiences the difference in the lesson situation, and can get clarification if necessary. The whole notion of the preparatory impulse I find valuable, possibly the more so from my experience as a musician, who always conceives the down-beat as a function of a preparatory up-beat. Not that these ideas are totally new—Alexander himself expressed their essence—but their reinforcement from Bernstein's perspective has been significant for me.

I will close on a philosophical note with three quotations that re-identify and emphasize the larger significance of the Alexander work. First, from Alexander, who said, ". . . throughout his long career man has been content to make progress in acquiring control of nature in the outside world, without making like progress in acquiring its essential accompaniment, the knowledge of *how to control nature within himself.*"[11] And then from Norbert Wiener, the father of cybernetics: "We have modified our environment so radically that we must now modify ourselves in order to exist in this new environment."[12] And finally from Bernstein: "The progressive growth in the complexity and power of technical devices has demonstrated very clearly that problems of control and regulation form an independent area of study—a study which is in no way less complex, important or comprehensive than that of the energies which are subordinated to these controls. The problem of the rider has begun to overshadow the problem of the horse."[13]

FOOTNOTES

[1]In my own teaching experience, pupils have expressed or implied similar questions.

[2]New York: Pergamon Press, 1967.

[3]*Beyond Reductionism* (New York: Macmillan, 1970).

[4]Jack A. Adams, *Learning and Memory: An Introduction* (Homewood, Illinois: Dorsey Press, 1976).

[5]Edward V. Evarts (September, 1979).

[6]New York: Doubleday, 1954.

[7]Bernstein, p. 69.

[8]Another factor is the small but real magnitude of supporting force in the teacher's touch.

[9]In fact, a main difficulty with the older models was that they didn't adequately account for the inherent plasticity of ongoing activity. A stimulus just came in, and was transformed by the system into a response that went out—a too-simple account of even such an act as getting a hot spoonful of soup from bowl to mouth, to say nothing of playing a concerto or giving an Alexander lesson!

[10]Bernstein, pp. 110-112

[11]Edward Maisel, ed., *The Resurrection of the Body* (New York: Delta Books, 1974), p. 87.

[12]Wiener, p. 46.

[13]Bernstein, p. 145.

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