Posture and Gravity

Part III

by Aline Newton

As bodies, we live in the field of gravity. Whatever other activity we are engaged in, be it sitting and reading this paper, walking, or playing, we also have to keep ourselves from falling over—we have to address the problem of the pull of gravity on our body. How we come to terms with this problem relates directly to what we commonly think of as posture. Moment by moment, below the level of consciousness, sensors are informing our brain of the location of each limb while the brain anticipates minute changes in our center of gravity as we move. At many levels data is collected and coordinated. The brain and nervous system orchestrate the perfect response to maintain our integrity, our uprightness, for the most part without our even noticing. This complex coordinative system could be called the postural or tonic system. It includes parts of the cortex, cerebellum, reticular formation, and brainstem, as well as nerve pathways, proprioceptors and exteroceptors, muscles spindles, golgi tendon organs, and special muscle fibers distributed throughout the body.[2] The oculomotor system and the inner ear play an important part, as do vestibular and neck reflexes. All parts are constantly occupied with keeping us upright in relation to the gravitational field, oriented, whatever task we may be performing. The basic action of breathing is intimately linked with this tonic, postural activity in several ways which are outlined below.

MUSCLES OF RESPIRATION ARE ALSO POSTURAL MUSCLES

The natural breath is dependent on the complex coordination of mechanical and chemical actions in the body. Staying upright depends on intricate patterns of interaction between nerves and muscles. Many muscles involved in natural breathing also participate in the activity of keeping us upright. Most of the muscles in the upper chest (pectoralis: minor and major: scalenes: sternocleidomastoid), for example, can be muscles of inhalation since their contraction can expand the ribcage. But we can also use them to hold ourselves up.

In breathing, the muscles of inhalation are tonic, postural muscles, while the muscles that can help exhalation are more phasic.

When this happens, the system becomes vulnerable: A small misalignment that has become habitual can lead to an excess of contraction in these tonic, postural muscles. This then prevents their release, their response to the weight of ribcage, as the mechanism of exhalation unfolds. Remember that normal exhalation is a passive process, one that does not require muscular effort. The extra postural contraction throws a wrench in the works: when the muscles of inhalation do not release, muscles of forced expiration will be called into play to pull the ribcage down. The next breath then requires extra force of contraction for the inhalation muscles, and so on. The needs of the gravity system can disturb the delicate balance of muscular coordination upon which an easy breath depends. The result: a vicious circle, a spiraling increase in tension.

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Postural muscles have more tonic muscle fibers. They are designed for endurance. In contrast, phasic muscle fibers, designed for bursts of action, work at high intensity for a short time. In breathing, the muscles of inhalation are tonic, postural muscles, while the muscles that can help exhalation are more phasic. In a contest between a mostly tonic and a mostly phasic muscle, the tonic muscle wins out, since it is designed for endurance. When the muscles involved in inhalation, such as the scalenes or pectorals, don't release,

the muscles of forced expiration have to contract against them to allow exhalation. In the end, however, the tonic muscles of inhalation are stronger. In practice, this means that it is more effective to work towards the release of the tonic muscles, the scalenes, for example, than towards strengthening phasic muscles of forced exhalation, like the abdominals. As we have seen repeatedly, strengthening the antagonists (the abdominals, in this case) will just lead to an overall increase in tension. Are the muscles of inhalation free to release? Check for restrictions in the mouth, the jaw, the palate, or any one of the cervical vertebrae.

The postural system as a whole adjusts to the movement of the breath. Another way in which posture and breathing interact can be seen in the movement the breath induces in the body as a whole. With each breath, there is a small, continuous oscillation of the body's center of gravity. Breathing in, or breathing out, the body is always moving; the postural system is constantly adapting to this subtle shift. If for any reason, the body holds against the shift, the muscular contraction will interfere with the breath. Neither inhalation nor exhalation will be complete. And since inhaling depends on complete exhalation and vice versa, as we saw earlier in the mechanism of breathing, when the postural system is unable to adapt, the restriction will be reflected in the breath. Gurfinkel found that what looked like restrictions in the breath could actually be attributed to problems in the gravity system.[3]

Clearly there is a close connection between the tonic activity of the body in relation to gravity, what we tend to call posture, and the responsiveness of breathing. Although apparent once described, like the gravity function itself, it is an aspect of breathing that is often ignored.

BREATH, TONIC POSTURAL ACTIVITY AND TWO DIRECTIONS

For the easiest breath, the body has to be comfortable adjusting to shifts in relation to the gravitational field. Posture has to be adaptable to changing demands so as not to interfere with the breath.

As Hubert Godard points out, when we speak of "relationship with gravity," posture, or tonic activity — the body's constant adjustment to changing circumstances — we are referring to a sensory experience. We experience gravity through information coming through our senses, from within and from without.

E. Reed describes posture as the orientation of the individual vis-a-vis the environment.[4] Thus it contains some information that is internal (proprioception) and some that is external (exteroception). Internal information is the sensation of one's own self: the sensations of proprioception and of the weight of the body. External information comes through the senses with which we orient; it is exteroception, the sense of the space around us, our environment.

According to Godard, these two kinds of perceptual information provide the basis for an inherent polarity of two directions, that can be expressed as up and down, or as inside and outside. As we will see, the way a person perceives the sensations related to these two directions, the way the information is received, will directly affect both the postural set and the mechanics of the breath. Ultimately it is the appropriate balance between the two directions that allows an effective relationship with gravity and easy and adaptive breathing.

SENSE OF WEIGHT

As we described in the preceding section, each breath induces a movement in the whole body. The oscillation of the breath brings about a weight shift which is registered by plantar baroreceptors as the pressure in the feet changes. The receptors' signal brings about a readjustment of the postural system via the spinal curves to preserve upright stance. Tension in the feet and back, the quality of the relationship with the ground, will all also influence the flow of the breath.

The ability to exhale depends upon a comfortable relationship with the feeling of the body's weight. Without appropriate support through the back and feet into the ground, exhaling, feeling the body's weight, can feel like falling, an instability. This may create an unconscious holding pattern ("holding up") which interferes with an easy flow of breath. Resistance to the sensation of the weight in any segment of the body will cause a holding of the breath in inhalation, an inability to exhale completely.

SENSE OF ORIENTATION

Breathing can be facilitated or inhibited depending on the state of the mechanisms involved in orientation. The degree of tonic contraction needed to maintain our upright stance in the field of gravity depends in part on the orientation system. The inner ear, the tension level of the cervical vertebrae and the position of the head all influence the level of tone of the body as a whole and will thereby influence the freedom of the breath.

The work of Matthias Alexander provides a good illustration: In scientific studies, Alexander's technique, which works to increase proprioceptive awareness, with a focus on movements of the neck, results in a distinct improvement in respiration—without ever directing attention to the breath itself.[5]

The quality of perception of the orientation system also has an impact on the mechanics of breath: Electromyographical research shows that the scalenes are primary in inspiration because they pull up on the upper ribs, thus increasing the diameter of the ribcage. However, as we noted above, Kapandji points out that these muscles can only help in inspiration when they can act on a cervical vertebral column that is stabilized.[6] Without this support, the scalenes would simply pull down on the cervical vertebrae, increasing the cervical lordosis.

Based on empirical evidence from training dancers over many years and borne out by his own electromyographical research, Godard has shown that the orienting senses, when properly activated, stimulate a relationship with the surrounding space that allows it to offer support for movement just like the ground. The perceptual receptivity to the space provides a direction that changes the pattern of muscle contraction in the spinal muscles, allowing them to stabilize the cervical vertebrae without excessive compression, putting the scalenes in a mechanically efficient position to lift the ribs for inhalation.

The movement of inhaling depends on the sensations of orientation; it is a movement upward and outward; exhaling is coming home, coming back into ourselves, feeling our weight. The movements and the breath are influenced by the perception of the sensations of the two directions.

TONIC POSTURAL ACTIVITY DEPENDS ON PERCEPTION, ON SENSATION

Godard emphasizes the distinction between sensation and perception: "The space of sensation is to the space of perception as the terrain is to geography. The space of perception is a geographic space. The structure of geographic space is in no way identical to the physical space (the terrain itself, the state of the body)."[7] Perception is an interpretation of information coming through the senses. Through descending pathways, the nervous system is always undergoing a selection process in relation to incoming information. Receptors from skin, muscles, joints, and all our senses are bringing signals towards the brain. The descending pathways are the control mechanism that chooses which sensations reach the brain. These pathways are influenced by our physical and emotional history (via the limbic system) and our state in the present.

As Godard points out in the two examples that follow, the perception of body sensations can be modified or even suppressed by the will or by a mistake in cognitive interpretation brought about through the other senses. In one study, subjects walking forward were exposed to films projected on the walls of the room that gave them the optical impression of moving backward. When asked, the subjects reported that they were moving backwards despite the actual forward movement of their legs.[8]

In another case, a workman who was accidentally locked in a freezer was discovered in the morning frozen to death with all the clinical signs of that condition. However, due to an electrical failure the previous evening, the freezer had not been on. He believed, and so it was.[9]

Many veils can obscure sensory information from the body and thus falsify its perception. These examples illustrate that perception and sensation are not a simple straightforward phenomenon. Perception is an action: an activity in which choices are being made. In part, these choices are a function of each individual's personal history. We have already seen that breath depends on the quality of tonic postural activity which itself depends on the perception of sensory information coming from inside and outside. Thus, a person's breath is a physiological event and a perceptual one. Habits of perception are strongly influenced by personal history and environment, assumptions and cultural customs. Meaning shapes perception. The breath will be a result of symbolism and psychology as much as it is of anatomy and biomechanics.

As Godard has described it, our experience of gravity has two directions, an inside (weight) and an outside (orientation). In breathing we also create a relationship between the inside and the outside. From this point of view, the experience of breath (like the experience of gravity) expresses the relationship between the person and the environment. It is an interaction. It raises issues of territoriality and control. Breath relates us to our world.[10] Each breath has a particular shape: the deep, calm breath of a sleeping child, the short "breathlessness" of anxiety, the resignation of a sigh. Through its ease, its depth, its rhythm, breath expresses the quality of that relationship at each moment.

In inhaling, we open a connection to the outside. Breath brings to us the smells of the world outside. Some draw us out while others repel us. We can welcome the air, trusting its flow, or we can struggle with it, pulling it to us—two very different breaths, two different expressions in muscle use and physiological effect. To have an easy inhalation, there needs to be a real sense of the space outside, a link to another. Exhaled, breath is voice. It

carries us beyond our own body, extending our frontier. It returns to us, as we hear the sound of our own voice. With the voice we reach out, and meet response or indifference, experiencing our power or our weakness.

Exhaling forcibly requires the same muscles as the action of pushing, what we need to be able to do to establish a space of our own. The symbolic significance of pushing, issues of autonomy and relationship, may lead to muscular holding[11]—holding back which restricts the movement of the ribcage either in inhaling or exhaling. This then impedes the freedom of the parts and interferes with a free and easy breath.

The quality of each breath reflects the complexity of our relation with the world. The physiological breath is a vehicle for the expression of being human.

IN PRACTICE

a. What does our breath do when we touch? It will be an expression of our relationship with our client.

b. The surface, the skin, the interface between the inside and outside of our body boundary, has as important a role to play as the center. Sensory stimulation, via tactile and temperature receptors in the skin, has a direct effect on the rate of breathing. The skin breathes; expanding and contracting like a third lung. Experience and physiology inform us that work with the skin, with the sense of touch, has a direct effect on the breath.

c. Understanding the interaction of the gravity system and the breath, suggests an indirect way to work with the breath: by working with a person's sense of his/her own weight, the proprioceptive sense or sense of inside, and with the sense of exteroception, of the space outside and around them. The work will be to balance the quality and quantity of sensory information coming from the two types of receptors, the two directions.

Even as simple a cue as to direct the eyes/the gaze slightly upward when inhaling, and towards the knees, or downward upon exhaling may change the quality of the breath. Our analysis above also reminds us that in context, to work with breath or with the perception of gravity, we will always have to take into consideration what the breath expresses for a given individual in a given relationship—be it with another individual or a group or the world as a whole. To affect the breath, beyond a superficial moment of voluntary control, is to work with the meaning of the movement.

CONCLUSION

Breathing is a fundamental expression of life. As such it is deeply related to other fundamental functions like posture and emotional expression. The study of breathing traces a circle in which physiology, mechanics and expression follow each other like the inhalation and exhalation of the breath itself.

The meaning dimension directly affects perception, sensation, and therefore posture and the mechanics of breathing, and through this path, directly impacts the physiology of the breath.

A person exists only in relation to their environment and not as an independent "objective" entity. Physiology does not describe the working of a machine: It is an expression of our being in the world. Breathing is a fundamental movement through which the whole human being-in-situation is expressed. Working in rehabilitation or to change patterns of breathing necessitates maintaining the broad view of a human being in the world with which we began this inquiry. It requires remembering to include ourselves, the practitioner, in the encounter. To consider a living being from the point of view of mechanics and biochemical functioning prevents any true meeting. To work with breathing requires as deep an understanding of psychodynamics as of science, and a willingness to begin always again with experience. This synthesis underlies effective, original work with the breath. ❑

1 This section is based on an untranslated paper by Hubert Godard, "Le souffle-le lien."

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3 Gurfinkel, V.S., et al, *Models of the structural-functional organization of certain biological systems*, Cambridge, MIT, 1971.

4 Reed, E., "Applying the theory of action systems to the study of motor skills," in Complex Motor Behavior, O.J. Meijer, K. Roth, Elsevier Science Publishers, Netherlands, 1988.

5. Barlow, W., *The Alexander Principle*, Victor Gollancz, London, 1973.

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6. Kapandji, I.A, *The Physiology of the Joints*, vol.3, Churchill Livingstone, NY 1974, p.148.

7. Straus, E. *Du Sens des Sens*, ed. J. Millon, Grenoble, 1989.

8. Lishman, J., Lee, D., "The Autonomy of Visual Kinesthesis" in Perception, 2, 1973.

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10. see Strauss, E., *Phenomenological Psychology*, Basic Books, Inc., New York, 1965. "The Sigh."

11. Conversely, a weakness in one of the senses of gravitational direction may lead to an inability to make comfortably the fundamental movement of pushing, which may be reflected in the experience of autonomy issues on a behavioural level.