Graviception: F.M. Alexander's Science of Poise

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Abstract

This article reviews some interesting research by Lackner and Jeka into the use of light touch to help subjects maintain their balance. The subjects' balance was challenged by requiring them to adopt 'tandem stance' (with the feet placed one in front of the other, heel to toe). The experimental evidence demonstrated the importance of light touch in helping people with and without sensory impairment and with and without the use of a cane to maintain their balance in these circumstances. Light touch was found to be as effective as support in maintaining balance. Touch was explored both It follows the author's personal experience in the teaching situation. The concept of 'poise' is briefly discussed before the experimental evidence is reviewed. The need for Alexander teachers to recognize the importance of light touch in the teaching situation is indicated.

***Poise** is a body state achieved only by steady and carefree education of the body and the maintenance of balance. Poise is a character of repose or rest in the good body, whether it is in the relatively static positions of lying, sitting, or standing or is actually in progressive motion during the activities of life's daily routine or of sport.*

Raymond Dart[1]

Light hands and primary control

Understanding F.M. Alexander's ingenious discoveries requires integrating behavioural sciences, arts, phenomenology, and many other disciplines. For most of my working life, my passion has been to synthesize information primarily from three broad fields: performing arts (dance), somatics (Alexander Technique, Ideokinesis, and other studies), and human movement science (particularly neuroscientific aspects). As an Alexander Technique (AT) teacher, one question that always captivated me was why teachers used light touch with students. Why not use more force? Since the teacher's hands are not manipulative, i.e. not 'making' the student move, then what are they doing? One answer is simple: AT teachers are looking to encourage poise in coordinated action (use).

A poised manner of use is a function of proprioceptive guidance, not muscular force. The more lightly the teacher touches, the less likely he or she is to manipulate the student, and the less likely the student, in turn, is to resist being touched (by stiffening) or overly relax (by collapsing). I began to notice, though, that my students more readily attained poise when they engaged their own hands in activity. The more I would bring contrasting weights and surfaces into the lesson experience (e.g. by the student touching different objects or standing on differently textured surfaces), the less I needed to use my hands to encourage a poised manner of use. Also, I noticed the ease with which students were able to employ their primary control in more dynamic standing postures (such as lunge) compared with in feet side-by-side, symmetrical stance (the more common way we ask students to stand in front of the chair).

I saw that I needed to look a level deeper at current theories of dynamic postural balance and relate them to practice. The research I wish to report here is designed to help inform our work. Science helps me stay open and agile to new concepts that might deepen my understanding of Alexander's discoveries. As artisans in the craft of coordination, AT teachers practice both an art and a science that is still evolving and opening like the 'great cauliflower'.[2] Going more deeply into any of the 'nodes' of the cauliflower expands and opens our understanding and appreciation of what Alexander unearthed. I should mention that the researchers whose work I am reporting here are not aware of the Alexander Technique, so the assumptions I am making are my own.

Poise

F.M. Alexander was revolutionary in developing a model of self-organization through learning to attend to one's own sensations and perceptions arising out of experience in a gravitational world. Alexander is considered the 'grandfather' of the somatic movement in western society,[3] and also the first somatic educator to propose that posture and movement are one continuum.[4] Alexander was after 'poise', a word deriving from the Latin 'pendere', meaning 'to weigh.' The preconditions for poise are best met in gravity, where we are constantly sampling and weighing our contact with the world. Poised action has nothing to do with 'posture' as position. Defining upright standing as a function of mechanical alignment in which one's centre of gravity (mass) stays within the base of support is insufficient. Instead, poise is reflective of dynamic postural control (i.e. balance),[5] a unified, ongoing *response* to gravity—a flexible, adaptive process of support governed by sensory awareness and constructive thinking.[6] Poise is achieved not by static stacking or aligning of bones, nor holding of body parts by muscular force, but rather by enlivening the relationship between perception and action. Science currently accepts that dynamic postural control (balance) includes perception-action coupling as a vital strategy in maintaining control.[7,8]

Graviception

How do we know we are vertical when we stand—oriented correctly in relationship to the earth's vertical? Both physical and behavioural scientists have deepened their understanding of balance over the last few decades. The conception of the body as a system of mechanical links and inverted pendulums (head and trunk) held together by stretch reflexes and the contractile and viscoelastic properties of muscles is insufficient to explain postural control. Two dynamic, integrated functional systems are currently identified for maintaining balance: one orienting the body to evoke anti-gravity support, the other providing perception-action coupling.[9]

Dynamic postural control requires 'sense-ability'. Our perception of our vertical is remarkably accurate under normal circumstances, i.e. those free of the influence of disease (stroke) or environmental perturbations (being on a surfboard) or anomalies (trick mirrors). Normally, we exist in a narrow cone of vertical accuracy in which we can detect 2 to 3 degrees of tilt as 'off-centre'. The integration of multiple systems gives us this remarkably accurate measurement of our body in relationship to the environment. The combination of visual, vestibular, and somato-sensory input provides a powerful multi-systems reference for upright orientation.[10] Autonomic regulation of organs (such as the kidneys and blood vessels) also might serve as potent reference systems for balance.[11] Somato-sensory input refers to that information coming into the nervous system from cutaneous receptors (skin), muscle spindles and golgi tendon organs, and joint afferents. Somato-sensory input is extremely abundant (or, redundant, to use a neuroscience term), versatile, and readily available. A 'proprioceptive chain' of somato-sensory receptors exists from head to toe, from the extraocular muscles in the eyes to the neck, trunk, hands, legs, and feet.[12] In a sense, we have many 'verticals', each one formed by different senses that are encoded and integrated in the nervous system to provide a unified spatial picture of an upright standing body in its environmental context. AT students can experience a 'mismatch' in their sense of uprightness when they move away from habit—as when they find head balance and experience a conflict between what the eyes see and how the head-neck-body feels to them. In cases of disease, such as stroke, the conflict between the patient's visual (seen) vertical and the somato-sensory (felt) vertical can make rehabilitation challenging and frustrating, since the patient might feel 'upright' when their body is actually tilted as much as 20 degrees.[13]

Fingertip Contact

If you've ever tried to navigate smoothly in a dark room, you might recall that you didn't lean heavily on the wall, but rather lightly touched the surface of the wall as you proceeded towards your destination. In fact, the more you leant passively on the wall, the more disorienting the experience. You might also recall how persons who are blind use their cane not as a physical support for the body, but rather as a telescopic 'eye', perceiving the ground through their fingers via the length of their cane as they walk along. In both cases, the information from light touch of the fingers (both near- and far-distance) is a powerful reference for upright balance when vision isn't available.

Researchers Lackner and Jeka noticed this common phenomenon of navigating smoothly in the dark using light touch, and set up experimental conditions to test several theories on how light touch could improve balance.[14] In their first set of experiments on 'normal' (i.e. non-neurologically impaired) individuals, the researchers had the subjects stand in tandem stance (heel to toe) on a force plate with another force plate located at the side of the body at waist height. The tandem stance (where one foot is placed directly in front of the other, with its heel touching the toe of the rear foot) is important, as it requires more dynamic postural control to stand this way than with the feet side-by-side (something for AT teachers to keep in mind). Three experimental conditions were tested: with hands by their sides ('No Contact' condition), 'Light Touch' (their index finger touching the force plate located to their side at waist height), and 'Unrestricted Force' (leaning on their finger on the force plate). The subjects were instructed to stand for 25 seconds in each of the 3 conditions with eyes open and then with eyes closed (6 conditions altogether). In the 'Light Touch' condition, subjects were asked to use *no more than 100 grams* of force in touching the plate or they would trigger an alarm. Lackner and Jeka measured centre of pressure displacement (in centimetres) of the body (i.e. the amount of body sway), centre of pressure displacement of the index finger, and electromyographic activity in the legs (EMG). They predicted that the amount of displacement of the body (centre of pressure displacement in centimetres) would be highest in the 'No Contact' condition, i.e., the body would sway the most, which was, in fact, the case.

With no support from the finger or other external object, the subjects' sway was larger with eyes closed than with eyes open, as you might expect. Since the amount of light touch dictated in the experiment was far below forces physically necessary to support the body, the researchers predicted that the 'Light Touch' condition would make little or no difference in the amount of sway of the body (2-3% attenuation, or reduction, in sway). To their surprise, light touch was able to reduce the body sway by 50-60% in both eyes open and eyes closed conditions, similar to when the subject was given permission to lean on the finger.

It is of further interest that in the 'Light Touch' condition none of the subjects had to be trained in how much force to exert through the index finger. Subjects averaged *less than 50 grams of force* through the fingertip at the point of contact, less than half the allowed value, as they modulated the pressure whilst maintaining their balance during the 25-second stance time. This suggests there is an in-built preference to use lighter rather than heavier touch in such circumstances, making it unnecessary for subjects to learn special behaviours to fit within the experimental constraints.

Practical exercise

Try this yourself. Go to a dimly lit room that has a smooth floor. Place a chair by your right side with the back of the chair roughly at waist height. Put your non-dominant foot in front of your dominant foot, heel-to-toe. (It's worth trying the experiment with either foot in front.) Now try the following:

1. Stand with your arms down by your side for 25 seconds (eyes open). Rest a moment.
2. Stand with your arms down by your sides for 25 seconds (eyes closed). Rest again.
3. Place your right index finger on the edge of the chair back and repeat conditions 1 and 2. What do you notice when you have your index finger lightly touching the chair? What is activating in your neck and back, your legs?
4. Finally, repeat the experiment by leaning on your finger.

Sensitivity at the fingertip

Lackner and Jeka found that even though fingertip forces alone were far below those physically necessary to stabilize the body in upright dynamic stance, the contact forces through the finger in the 'Light Touch' condition actually *decreased* as the body sway increased. Additional stabilization for the body was met by increasing somato-sensory acuity, not force![15]

Contact with any body part might influence body orientation and dynamic postural support. When a fingertip is lacking, one might well resort to balancing via their forehead or nose, for example. The cutaneous receptors of the index finger are the most sensitive, however. The many cutaneous receptors of the fingers (slowly- and rapidly-adapting sensory afferents) provide us with incredibly precise and accurate tactile information about touch, pressure, movement, temperature, pain, and more. The fingertip can discriminate two points 2 millimetres apart. Receptor density in the feet is such that discrimination thresholds are 8 to 10 mm, interestingly the approximate mean level of sway Lackner and Jeka observed in the 'No Contact' condition with the eyes closed. The feet were definitely lively when the fingertip was not engaged with the force plate. The researchers hypothesized that postural trunk muscles remote from the fingertip helped stabilize the body, i.e. the fingertip receptors were providing sway-related feedback along with arm proprioceptors that triggered activation of the deep spinal muscles of the trunk. This is similar to the way a blind person might use a cane as a fingertip, i.e. as an investigatory detector and modulator of upright orientation. This they confirmed by looking at the EMG patterns in the legs, in which the lower leg muscles were most activated in the 'No Contact' condition, followed by 'Light Touch'. The leg muscles were least activated in the 'Force' condition when the body was leaning more passively through the hand.

Subjects with sensory challenges

The researchers went on to study the same phenomenon in persons with sensory challenges: vestibular disorders and congenital blindness. Persons who have impaired function of both vestibular organs must rely strongly on vision for balance. Ordinarily, they would not be able to stand for more than a few seconds if asked to stand in tandem with eyes closed. Light touch through the index finger not only enabled these persons to stand for the same length of time as normal subjects, but also the changes in force through the fingertip actually *led* the body sway by 250 – 300 milliseconds. The fingertip was actually anticipating changes in sway rather than merely reacting to the sway![16] Vestibular rehabilitation is a hot topic among medical practitioners. This research helps support our work in helping persons with vestibular disorders activate postural stabilizers in the trunk through light touch (from their own fingertips or from their teachers').

In comparing subjects with congenital blindness to normal (seeing) controls, Lackner et al set up similar laboratory conditions, but using a cane that was held by the subjects both vertically (perpendicular to the ground) and slanted away from the body at an angle of 30 degrees to the ground.[17] All subjects were able to control body sway more readily and easily with lower force when the cane was slanted at 30 degrees (the actual plane of sway). This research indicates the importance of making clients aware of the potential of a cane as a perceptual tool rather than just as a support mechanism.

Implications for teachers

What implications does this research have for us as teachers of the Alexander Technique? Our goal is clearly not to 'attenuate postural sway' but to encourage constructive conscious employment of the primary control in order to attain poised use. However, there are several important things to derive from this research and others that could help our students. First, our field already builds into lessons activities that stimulate an improved use of the primary control by engaging touch, for example 'hands on the back of chair', or working with activities. Bringing variation into the picture in the same lesson—through different dynamic stance positions, placing the chair in different orientations, or simply changing the texture of the contact surface (either in the chair or the feet)—might stimulate further improvements.

This is an exciting time for research in dynamic postural control, and we are coming closer to an understanding of an Alexandrian concept of 'poise' and how sense-ability can help us achieve it.

To quote philosopher David Applebaum:

> Before poise can reveal itself, a tension that is the psychophysical milieu of accomplishment must ease…All evidence suggests that poise is not the natural outgrowth of a process that begins in distraction, preoccupation, and insensitivity.[18]

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Notes/References

[1] Raymond Dart, 'The Attainment of Poise' in *Skill and Poise* (London: STAT Books, 1996), 114.

[2] 'Be patient; stick to principle; and it will open up like a great cauliflower': Albert Redden Alexander quoted in Frank Pierce Jones, *Freedom to Change*, first published as *Body Awareness in Action* (3rd edition, London: Mouritz, 1997 [1976]), 110.

[3] Michael Murphy, *The Future of the Body: Explorations into the Further Evolution of Human Nature* (Los Angeles: Jeremy Tarcher, 1992).

[4] Edward S. Reed, 'An outline of a theory of action systems.', *Journal of Motor Behavior*, 14/2 (1982), 98–134.

[5] Fay B. Horak and Jane M. Macpherson, 'Postural orientation and equilibrium' in Rowell, Loring B. and John T. Shepherd (eds), *Handbook on Integration of Motor Circulatory, Respiratory, and Metabolic Control During Exercise* (Bethesda, MD: American Physiological Society, 1996), 255–92.

[6] See F. Matthias Alexander, *The Use of the Self* (London: Victor Gollancz, 1985 [1932]).

[7] James J. Gibson, *The Ecological Approach to Visual Perception* (Hillsdale, NJ: Lawrence Earlbaum, 1986).

[8] Keith Davids, Paul Glazier, Duarte Aráujo, and Roger Bartlett, 'Movement systems as dynamical systems: the functional role of variability and its implications for sports medicine', *Sports Medicine*, 33/4 (2003), 245–60.

[9] Jean Massion, Alexei Alexandrov, and Alexander Frolov, 'Why and how are posture and movement coordinated?', *Progress in Brain Research*, 143 (2004), 13–27.

[10] Lewis N. Nashner and Gin McCollum, 'The organization of human postural movements: a formal basis and experimental synthesis', *Behavioral Brain Science*, 8 (1985), 135–72.

[11] Horst Mittlestaedt, 'Origin and processing of postural information', *Neuroscience and Biobehavioral Reviews*, 22 (1998), 473–78.

[12] Jean-Pierre Roll and Régine Roll, 'From eye to foot: a proprioceptive chain involved in postural control' in B. Amblard, A. Berthoz, and F. Clarac (eds), *Posture and Gait: Development, Adaptation and Modulation* (Amsterdam: Elsevier, 1988), 155–64.

[13] Hans-Otto Karnath, Susanne Ferber, and Johannes M. Dichgans, 'The origin of contraversive pushing: Evidence for a second graviceptive system in humans', *Neurology*, 55/9 (2000), 1298–1304.

[14] John J. Jeka and James R. Lackner, 'Fingertip contact influences human postural control', *Experimental Brain Research*, 100 (1994), 495–502.

[15] John J. Jeka, 'Light Touch Contact as a Balance Aid', *Physical Therapy*, 77/5 (1995), 476–87.

[16] James R. Lackner, Paul DiZio, John J. Jeka, et al., 'Precision contact of the fingertip reduces postural sway of individuals with bilateral vestibular loss', *Experimental Brain Research*, 126/4 (1999), 459–66.

[17] John J. Jeka, Randolph D. Easton, Billie L. Bentzen, and James R. Lackner, 'Haptic cues for postural control in sighted and blind individuals', *Perception & Psychophysics*, 58/3 (1996), 409–23.

[18] David Applebaum, *The Stop* (Albany, NY: SUNY, 1995), 15.