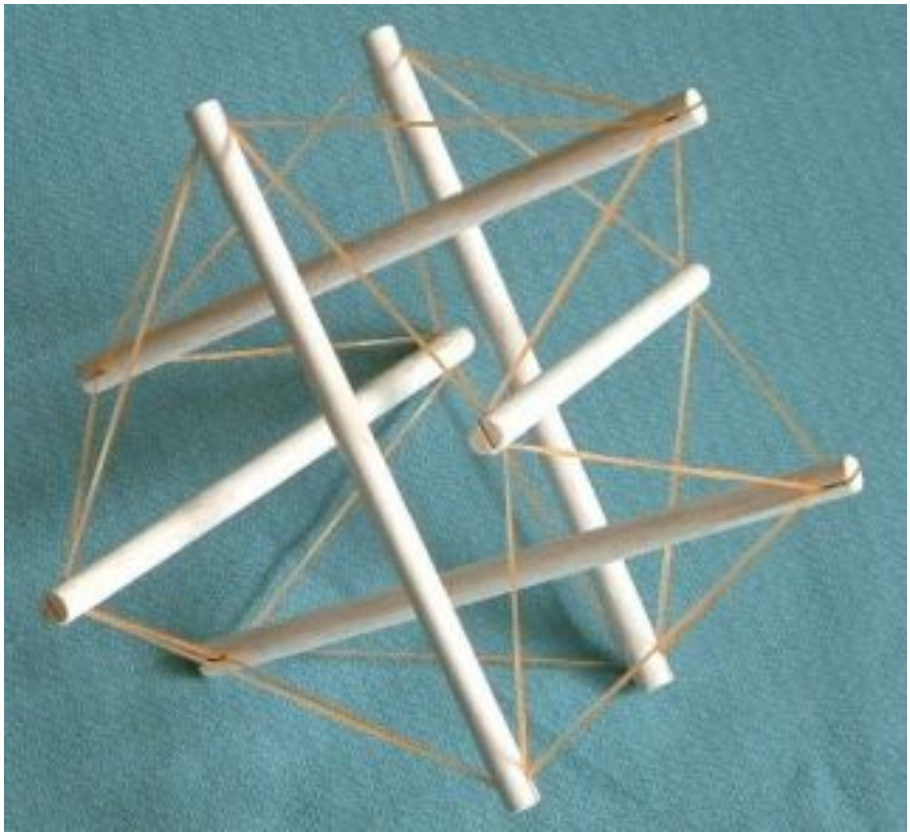
SOME THOUGHTS ON STEADICAM POSTURE

CHRIS FAWCETT
f@wcett.com

TENSEGRITY

In considering what the best posture for Steadicam operation might be, we'll have a closer look at what posture is. Throughout history, the manner in which we have made sense of all the various workings of the human body has had a parallel in technology. The Ancient Greeks imagined that the mind was driven by systems of levers and pulleys; the early Victorians thought it a series of valves that allowed pressure to be built up and released; later we hit on electricity, and subsequently replaced the valves with transistors. In current thinking, philosophers model minds on parallel processors, and comparisons will hardly cease. As regards the rest of the body, understanding increases in fits and starts, but one area that has resisted explanation until fairly recently is posture. In the consideration of how we defy gravity, we're stuck in Ancient Greece.

Classical anatomical studies of posture see the skeleton as a load-bearing structure, with series of muscles exerting leverage through tendons. This is not the whole picture, and for a better understanding, we turn again to technology. In ***Tensegrity***, R. Buckminster Fuller stated: *"Engineers told me, before my full-scale demonstrations of Geodesic structures, that Geodesics would not work."* Yet today, geodesics are in common use in everything from garden tents to radar domes. Why the initial scepticism? The Oxford English Dictionary defines tensegrity as: *"A stable three-dimensional structure consisting of members under tension that are contiguous and members under compression that are not."*



Before ***Tensegrity***, it was not generally appreciated that gravity-resisting structures might be built wherein the compression elements did not touch.

ANATOMY

It's been wondered how the skeleton can withstand both sudden impacts, such as the heel striking the ground, and lifetime usage, such as the hip joint rotating in its capsule. We've known that shock-absorbing systems are in use, but the nature of these systems is only now becoming understood. ***Continuous Tension, Discontinuous Compression*** states: *"Axial loads were applied to joints in live subjects under anaesthesia during surgical intervention for a variety of conditions. Joint studies included the knee, ankle, elbow and metatarsal-phalangal joints. In our studies at no time could the* ***articular surfaces*** *of these joints be forced into contact with one another as long as the ligaments remained intact."* [Levin 1982].

Levin goes on to discuss how the ligaments that run the full length of the spine, front and back (the *anterior* and *posterior longitudinal ligaments),* are in **continuous tension**. If cut, "*the vertebral column expands."*

"a continuous tensional network (tendons), connected by a dis-continuous set of compressive elements (struts, i.e. bones), forming a stable yet dynamic system that interacts efficiently and resiliently with the forces acting upon it." [Oschman 1997]

A joint can last a lifetime of reasonable use, though its cartilage lining is avascular—not equipped with a blood supply to speed repair. Why? If the joint is well supported, it doesn't carry all the load. Loads are spread throughout the body by webs of interconnecting tissue.

In the tensegrity mast below, none of the compression members is in contact with any other, yet the structure is so resilient it can be picked up and turned on its side. Any loading on a tensegrity structure is distributed evenly through-out the entire system.

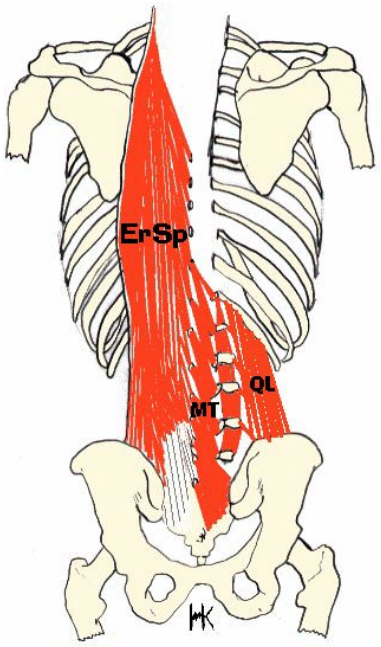
"In relation to the spine, the tensegrity principle suggests that when the soft tissues around the spine are under appropriate tension, they can 'lift' each vertebra off the one below it. This viewpoint sees the spine as a tensegrity mast, rather than a stack of blocks." [Robbie 1977]

POSTURE

Since the body is not a stack of blocks, it can readily adapt to novel situations such as hefting a fully-loaded Steadicam. There is great redundancy built into our articulation systems, but if they are not used right, they eventually fail. Though we all know of someone that slipped a disc "just stepping off the sidewalk," we tend to ignore the 20 years of bad use that led up to it. We are designed to develop an effective posture in response to our environment, but the modern world (in which we spend 14 of our formative years sitting in chairs) is not the hunter-gatherer one to which we are evolved to respond. Correspondingly, we can't step into a Steadicam, and expect automatically to develop an appropriate response without invoking a certain amount of conscious control. Let's now consider some aspects of posture relevant to Steadicam.

"All of our muscles are composed of Type 1 and Type 2 muscle fibers. Type 1 muscle fibers are often referred to as slow twitch, while Type 2 muscle fibers are often termed fast twitch. Type 1 fibers are characterized by smaller size, less force capacity and ***more endurance capacity*** *They are the dominant muscle fibers in endurance activities.…Type 2 fibers are characterized by larger size, more force capacity and less endurance capacity. They are the dominant muscle fibers in power activities."* [Westcott 1999]

Systems of muscles that are designed to support the body against gravity, the postural muscles, are built primarily of Type 1 muscle fibre, which can fire all day when dealing with an accustomed load. If we are to keep our *articular surfaces* supported, we must use ourselves in such a way that the postural muscle groups support the load, as they are designed to do—and leave our skeletons free to articulate, as they are designed to do.



The *paraspinal* muscles, shown in cutaway opposite, whose functions are to *"extend the spine as well as to provide support for it,"*[Global Spine] consist of global muscles, like the *erectors spinae,* and local muscles like the *multifidus,* that are dominated by Type 1 fibres. *"Global muscles act like guy wires, while local muscles attach directly to the spine and provide segmental stability."* [Knudsen]

They are also known collectively as the *"antigravity muscles"* [Kornberg], but for our purposes, we can refer to them, like Garrett Brown does, as **that** muscle.

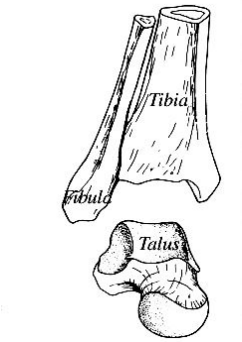
AVOIDANCES

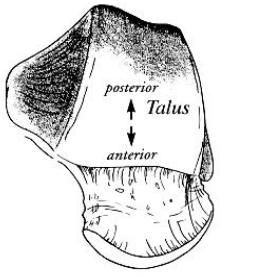
The carrying capacity of the postural muscles must be built up gradually, in the way that a woman builds up her capacity to carry a full-term pregnancy. For the back to be properly supported in a standing position, **that** muscle must work continuously—and when subjected to an unaccustomed load out front, such as an Ultra Cine with bells and whistles, it will hurt. We can adopt a variety of avoidance postures in an attempt to shift the load, but the point of this discussion is to argue against them. Let's examine three of the most common. (I apologise at once for using people's images, especially as the operators have probably been caught off step, and the posture indicated may not reflect their normal operating position; but rather than mock up examples, I wanted to draw from real life. Anyone that wants his or her image replaced, please email me directly.)

#1 THE TOWER OF PISA

Often, the first reaction to 'weighing' a Steadicam is simply to fall away from it to counterbalance the weight. Keeping the usual posture, and leaning backwards is a disorientating solution, but its main failing is to introduce unaccustomed forces into a body that is used to being vertical, especially in the way the load is delivered into the ankle joint.

As you see below, the two leg bones, *tibia* and *fibula* converge from either side on the *talus* of the foot, and grip it like a pincer. When the ankle joint is in *plantar flexion* (as in *Pisa), "the posterior (narrower) part of the talus is in the 'pincer,' and the joint therefore less stable."* [Calais-Germain 1993] As such, it requires more support from the surrounding muscles and ligaments to hold it together. Transferring your bodyweight plus 50% through your ankles in this way is asking for trouble.





As most sprains occur when the ankle joint is in *plantar flexion, Pisa* is an unstable solution in more ways than one.

Right ankle joint from front

#2 The Guitar Hero

Once it becomes clear that *Pisa* renders normal locomotion difficult, operators usually straighten up, but in an effort to get in an extra few hours of practice early on, a ready relief from the pain in **that** muscle is to disable it by throwing the body backwards from the hip. The *paraspinal* complex can relax because the weight of the head, torso, plus a good deal of the Steadicam is being driven down the spine into the sacrum—bone and gristle all the way. Now the spine ***is*** working like a stack of blocks, though don't expect it to stand as long as the Parthenon. Your shock-absorbing webs of muscle and tendon are substituted by delicate *vertebral articular facets.*

If the spine is to carry weight, it is the *articular facets* (or the *inter-vertebral discs)* that must do the work. *"Spinal arthritis occurs when the cartilage in the joints is worn down as a result of wear and tear, aging, injury or misuse."* [Regan] Arthritis of the spine, especially the lumbar spine, is primarily a result of misuse of the facets to bear weight that is best borne by other means.

Guitar Hero is a viable mode of operation only for someone with a young back.

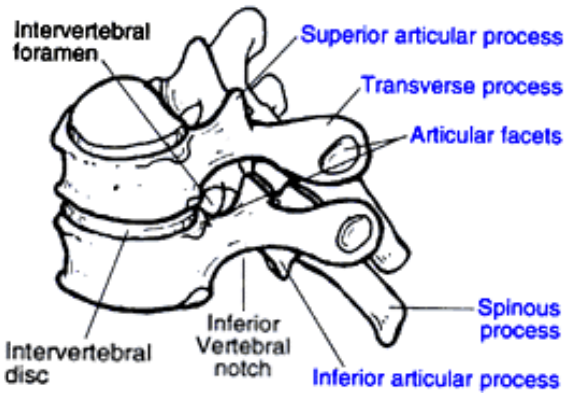


Illustration of 2 spinal vertebrae.
The rear of the spine is to the right

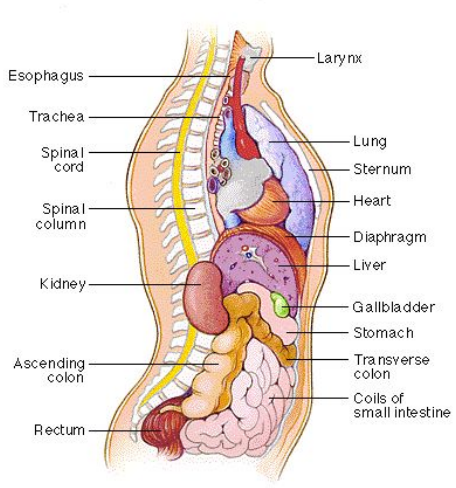
#3 THE WHOOPIE CUSHION

Whoopie is more of a bad habit than a complete avoidance. The operator, in tilting the head to view the monitor, allows the head and neck to fall forward, and the shoulders to follow. Instead of remaining upright, with the head inclined slightly down, and letting the *paraspinal* complex do all its work, the operator allows the back to stretch out, and the spine to curl forward, thus transferring weight out of back and into the front of the body.

Whoopie is problematic. The *articular facets*, as mentioned before, are situated to the rear of the spine, so when the back bends forward, weight comes onto the *intervertebral discs.* This leads to a chain reaction, in which the lungs work as airbags to transfer this weight through the diaphragm and into the abdomen, where networks of abdominal and pelvic muscles come into play.

Combined with a tight waist belt, increased pressure in the abdomen will reduce blood flow returning from the legs, and may result in their cramping. With the subsequent need to control breathing, such that it not effect the trim of the rig, an operator in this posture may also suffer shortness of breath.

The more tension you can keep out of your front, the better. As you can see below, there is enough going on in there already.



Whoopie is not recommended following a heavy meal.

TOWARDS A BALANCED OPERATING POSITION

To counterbalance the Steadicam, weight must be cantilevered behind the feet. In *Pisa,* the entire body is canted, the higher regions contributing most to the counterbalance. In *Guitar Hero,* the shoulders and head do the work. In *Whoopie,* the thorax is offered. Ideally (given that our centres of gravity lie in our abdomens), if we could keep the body, neck, and head upright and move it all back, away from the legs, we shouldn't have to move it very far. Look at the experts.

In these three pictures, the operators maintain ordinary postures, yet compensate the load. All keep their bodies close to the rig, and none looks remotely in difficulty. In the middle picture, Laurie Hayball is wearing a Steadicam that is perhaps half her weight, and is entirely comfortable. Before her, a dozen big guys had struggled with the same rig, grunting and sweating, bending themselves out of shape trying to adjust to it.

When you feel the load coming on, a first reaction is to brace the front of the body. Don't. Try to find the muscles that are holding on, and let them go. This is anything but easy: postural muscle complexes are not designed to be under conscious control, so are hard to 'find.' When you do find this group, and relax it, you will feel your torso expanding, your belly softening, and your chest floating up; the front of your pelvis will rotate forward and down, allowing a long curve to fall into your lower back (and your butt to stick out). The entire front of your body will feel 'open,' and weight will carry through the *length and breadth* of your back. If you are wearing an unaccustomed Steadicam, you will now feel **that** muscle take the strain. (See exercise on following page.)

CONCLUSION

Good Steadicam posture is about consciously letting go and allowing your body to deal with the weight. A tensegrity structure works, not by jamming the compression struts together, but by allowing them to fall apart under gravity. You must allow gravity to fall through your body, and allow the postural muscle systems to work uninhibited.

When you wear a Steadicam, a balanced response to the weight is—keeping your front 'open'—to let your torso move back and up from the load. Allow your legs to 'fall' away from your torso, holding on at neither the hips, knees, nor ankles. Permit your back to *lengthen and widen* from your tail-bone all the way up through your neck to your skull, thus allowing the *paraspinal* muscles to transmit the load through the backs of your legs and into the ground. When **that** muscle hurts, rest, and try again. It will adjust eventually, without your having to resort to any other measure. All I'm saying, is what Garrett Brown puts into three words: *Stand up straight!*

EXERCISE

If you absolutely must tone up the *paraspinal* muscles without recourse to a Steadicam, try the exercise pictured below, with these provisos:

Before raising your upper torso, rotate your pelvis such that your groin presses into the floor and your lower back is drawn out. Otherwise, the exercise will shorten the muscles as you strengthen them. **(The muscles you contract to achieve this correspond to the group you are asked to relax in the previous page.)**

Start with your forearms on the ground, and work up to the example below. Don't go nuts on repetitions. Just raise your upper torso, and maintain it there some seconds. Don't lock off, and remember to breathe. If you can't hold a conversation while doing it, you're not doing it right.

Don't scrunch up your spine. Keep your back and neck long, and your legs relaxed.

Fly safe.

A NOTE ON THE ALEXANDER TECHNIQUE

I recommend anyone wishing to work on posture to look into the Alexander Technique. You can't learn it from books, so find a good teacher. (They come in all flavours; so take the time to fine one that suits you.) It is correspondingly difficult to describe, so I'll begin with what it is not.

It is not a therapy, like Chiropractic, but an education. You do not go back for the same treatment. You learn progressively how your body works, and you build upon it.

It is not an exercise regime, such as Pilates. What you learn, you apply to whatever it is that you do every day.

It has no spiritual dimension.

REFERENCES

Buckminster Fuller, Richard 1961 *Letter on Tensegrity*

Calais-Germain, Blandine 1993 *Anatomy of Movement*

Fitstep *Anatomy of the Back Muscles*

Global Spine *Anatomy: Back Muscles*

Gray, Henry 1901 *Gray's Anatomy*

Knudsen, Howard *Multifidus: Anatomy, Function, and Dysfunction*

Kornberg, Charles *Glossary of Physiotherapy Terms*

Levin, Stephen 1982 *Continuous Tension, Discontinuous Compression: A Model for Biomechanical Support of the Body*

Oschman, James L 1997 *Gravity structure and emotions (Journal of Bodywork and Movement Therapies)*

Regan, John J *Arthritis and Your Spine: Introduction*

Robbie, David L 1977 *Tensional forces in the human body (Orthopaedic Review)*

Rosen, Richard *Yoga Research and Education Center*

Westcott, Wayne L 1999 *How Many Repetitions? (Natural Strength)*

DISCLAIMER