

Default Settings

by Daniel J. Schneck

In Italian, it goes like this: “*Se non è vero, è ben trovato*”; in English, “Although it may not be true, it is well conceived!” The “well conceived” part acknowledges that the logic used to arrive at certain conclusions does follow directly from the set of well-defined assumptions upon which it is based (as opposed to non sequiturs, which do not). The “may not be true” part warns us not to fall into the trap of tacitly taking for granted (by default) that this particular set of assumptions is, itself, universally valid. Thus, in any given situation where those assumptions are violated, the conclusions derived from them are simply wrong! Stated another way, beware of the tendency to implicitly rely on “default settings” (reference values that are automatically applied when others are not explicitly specified) to base conclusions on unsubstantiated and unjustified presumptions of fact. Seven examples from my consulting practice in forensic biomechanics suffice to illustrate this automatic human tendency, absent any convincing evidence to the contrary.

- *Default setting: Higher equals pathologic*: Here, it is subjectively assumed that if the biomechanical loading on human body tissues is (qualitatively) higher in one set of (usually work-related) circumstances than it is in another, then the former, by default, represents a risk to one’s health. This clearly implies that one should never get out of bed, because the vertical loading on the human spine is higher when standing than when lying prone in bed. Thus, standing up is dangerous to one’s health! Never mind that this loading, when objectively quantified, can be shown to lie well within the envelope that defines the tissue’s ability to tolerate such loading without consequence. Higher automatically means “excessive,” hence harmful, hence posing a risk of injury.
- *Default setting: “Correlated with” means “causing”*: If a set of circumstances is statistically correlated with a disease, it is presumed to be the cause of that disease. Here, one must caution against taking epidemiological investigations to extremes. Epidemiological studies can be suggestive, even persuasive, but statistical probability does not define cause and is certainly not conclusive. Indeed, “can cause” is not synonymous with “does (or did) cause” as it relates to considerations of necessary and sufficient conditions for causation. Moreover, the laws of probability tell us that large numbers of anything are statistically bound to create coincidences, and so one must further distinguish between which events are connected in a direct cause/effect way, and which are linked only by random chance. This is especially important when there are large numbers of confounding variables that cloud the issue of direct causation.

Common sense goes much further than ergonomics.

- *Default setting: Discomfort inevitably leads to disease*: Here, it is subjectively assumed that if one experiences (perceived) discomfort (due to ill-defined “awkward positions”) in the (qualitative) performance of certain tasks, then such discomfort is a direct risk factor for destined disease. Again, one must be equally careful not to take ergonomic investigations to extremes. Studies of work-related energy expenditure as a function of “safe” worker tolerance for such expenditure often suffer from a variety of issues, among them: a lack of rigorous, objective, operational, quantifiable definitions for the variables involved; a paucity of reliable anthropometric data that are required for kinetic formulations; a preponderance of preconceived bias that leans toward mainstream consensus; and the tendency to extrapolate and generalize based on limited biomechanical measurements, poor experimental designs that guarantee self-fulfilling prophecies, unsubstantiated assumptions, and sweeping non sequiturs. To my way of thinking, the physiologic signal of discomfort is the body’s attempt to optimize performance in accordance with an underlying minimum energy principle. It does not necessarily warn of an impending injury; “easier” is not synonymous with “safer.” And whereas I do agree that injury *might* follow if the signal is totally ignored, I do not consider that sequence to be automatic and inevitable. Common sense goes much further than ergonomics (in other words, *listen to your body!*).
- *Default setting: Body tissues fail in accordance with a “straw that broke the camel’s back” principle*: Borrowed from the common mechanics example of bending a rigid paper clip back and forth until it breaks under fatigue loading, this principle is typically applied to “cumulative stress disorders” (whatever *that* means!). The reasoning is that if physiologic tissue is subjected to “repetitive” stress cycles (not quantified), each will produce a microtrauma. Over time, these tiny injuries will eventually add up to a serious affliction. Never mind that nobody has actually documented a “microtrauma”—patients do not usually seek medical attention until they experience symptoms of a major injury. Never mind that unless body tissues are stressed at a rate faster than they can repair, they routinely fix “microtraumas” overnight (thank you, growth hormone). Never mind that the poor camel’s back keeps having weights added to an accumulating state of affairs, progressively ramping up to a yield point beyond which the animal’s back fails, whereas cyclic loading on physiologic tissue is alternately applied and removed; each cycle is essentially independent of the previous one; the load is not sequenced in a way that “adds up” to “cumulative trauma.” Again, if you stay within the body’s load-bearing envelope, there is no “accumulation” of strain that

is analogous to the fatigue failure of our metal paper clip. Human tissue has viscoelastic properties and it can heal. The paper clip can't, and it is far less elastic. Thus, using a "straw that broke the camel's back" analogy is tantamount to comparing apples and oranges.

- *Default setting: "Post hoc, ergo propter hoc" (After this, therefore as a result of this):* Quite (erroneously) common in the medical community, the assumption that underlies this setting is that cause and effect are temporally related in such a way that whatever immediately preceded an effect caused it! This is the reasoning behind the "was asymptomatic before, and symptomatic after, therefore . . ." justification for the establishment of causation based solely on circumstantial evidence. It works fine to explain that your hitting me over the head with a sledgehammer caused my skull to crack open; it's not that obvious when applied to degenerative musculoskeletal afflictions that are classified as idiopathic ("of no known cause"), partly because they involve a laundry list of confounding variables. This default setting also results in non sequiturs.
- *Default setting: As it relates to issues of causation, physicians are the ultimate authority.* Today, biochemists, biomedical engineers, physiologists, and other health professionals are actually much more qualified to address issues of causation than are practicing physicians, whose primary concern is diagnosis and treatment. Physicians' opinions about cause, especially as it pertains to idiopathic muscu-

loskeletal afflictions, are often speculative, conjectural, and unsubstantiated by hard scientific evidence.

- *Default setting: Patient was exposed to work-related "risk factors" that caused him or her to develop certain musculoskeletal diseases:* Here again, biostatistics can be used to prove just about anything you decide you want to, a priori. What fascinates me is the paucity of studies that suggest that the patient's work activities might actually have *delayed* the onset of a musculoskeletal affliction that the individual was destined to develop anyway, due to a variety of other predisposing factors. The latter is an example of a point of view *not* considered a priori, and, therefore, a result not reported because the experimental design was not so-oriented and the investigator involved chose not to look for it!

Not to belabor the point, but consider this: *Progress is often preceded by the need to shatter the assumptions that underlie state-of-the-art (mainstream) thinking and reset default values.*



Dr. Schneck is W.S. White Distinguished Professor Emeritus of Engineering Science and Mechanics, Virginia Tech, P.O. Box 396, Christiansburg, VA 24068-0396, U.S.A.; tel.: 540-382-6496; fax: 540-382-0915; e-mail: adanielj@vt.edu.